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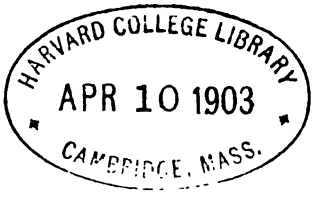

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ITHACA OR LEUCAS?

INTRODUCTION

Until recently there has been general agreement among scholars that modern Ithaca was Homeric Ithaca; but there have been two notable exceptions: Herscher and Völker. The former does not believe that the author of the Homeric poems had any actually existing and definite island in mind as the home of Odysseus, and holds that the island and its details are purely imaginary,[1] the latter, while believing in the reality of the island, locates it west of Cephallenia and somewhat further south than modern Ithaca, but does not attempt to reconcile Homeric with modern geography in general.[2] Those who accept modern Ithaca as Homeric Ithaca disagree, however, as to the location of the city of Ithaca, and consequently as to the topographical details of the island, some of which are dependent on the location of the city. Many scholars agree with Gell[3] in locating the city at Ætos, on the isthmus, in the middle of the island; prominent among these are Dodwell, Goodisson, Kruse, Schreiber, Thiersch, Rühle von Lilienstern, Klausen, Mure, Grivas, and Ansted.[4]

[1] Herscher, R., "Homer und das Ithaka der Wirklichkeit," *Hermes*, I. pp. 263–280.

[2] Völker, K. H. W., *Ueber Homerische Geographie und Weltkunde*, Hannover, 1830.

[3] Gell, Sir William, *The Geography and Antiquities of Ithaca*, London, 1807.

[4] Dodwell, Edw., *A Classical and Topographical Tour through Greece during the Years 1801, 1805, and 1806*, London, 1819; Goodisson, *Historical and Topographical Essay on Corfu, Leucadia, Ithaca, etc.*, London, 1822; Kruse, *Hellas;* Schreiber, C. C. E., *Ithaka, oder Versuch einer geographisch-antiquarischen Darstellung der Insel Ithaka nach Homer und den neuern Reisenden*, Leipzig, 1829; Thiersch, *Briefe aus Griechenland*, Leipzig, 1866; Rühle von Lilienstern, *Ueber das homerische Ithaka*, Berlin, 1832; Klausen, in *Zeitschrift für Altertumswissenschaft*, II. 1835, No. 17; Mure, *Tour in Greece*, Vol. I. chap. 6; Grivas, N. K., *Ἱστορία τῆς νήσου Ἰθάκης ἀπὸ τῶν ἀρχαιοτάτων χρόνων μεχρὶ τοῦ* 1849, Athens, 1849; Ansted, *The Ionian Islands in the Year 1863*, London, 1863.

Others accept the theory of Leake,[5] according to which the city was located at modern Polis, on the western coast of the northern part of the island. The chief advocates of this theory are Bursian, Lolling, Partsch, Gandar, and Bowen.[6]

Recently Dr. Wilhelm Dörpfeld, First Secretary of the German Archæological Institute at Athens, after an investigation of the question, announced his theory that Leucas is Homeric Ithaca, and for several years he has been conducting excavations in Leucas in the belief that his theory would be sustained by archæological evidence. The results of his excavations were presented from time to time during the winter of 1900–1901 in lectures delivered by him at the Institute in Athens, which were briefly reported by the daily press of the city. These lectures the writer had the privilege of hearing, as well as one delivered by Dr. Dörpfeld before the Parnasos Society of Athens during the same winter, in which he presented his reasons for adopting his theory.

It is the purpose of this paper to discuss, from the literary and topographical evidence, the question of the location of Homeric Ithaca, considering especially the comparative claims of Leucas and Ithaca. The details concerning Ithaca given in the Homeric poems will be assembled and an attempt made to determine to what degree each of the islands satisfies the requirements of these details.

[5] Leake, W. M., *Travels in Northern Greece*, III. pp. 24–54, London, 1835.

[6] Bursian, C., *Geographie von Griechenland*, Leipzig, 1862; Lolling, H., *Hellenische Landeskunde;* Partsch, J., *Allgemeine Zeitung, Beilage zu*, Nr. 239; Gandar, E., *De Ulyssis Ithaca*, Paris, 1854; Bowen, G. F., *Ithaca, Corcyra*, etc., 1850.

CHAPTER I

Homeric Ithaca

1. That Homeric Ithaca was an island is clear from a number of passages.

While Eumæus is entertaining the beggar he explains to him the situation with reference to Odysseus, and, among other things, tells him that no prince had as much property as Odysseus, either on the mainland or in Ithaca itself.[7] Here Ithaca is contrasted with the mainland in such a way as to imply that it is an island. Again, at the fight between the beggar and Irus in the palace of Odysseus, Antinous, one of the suitors, tells Irus that, if he lets the beggar conquer him, he shall be sent in a ship to the mainland to king Echetus, who will cut off his nose and ears.[8] Here we have the same contrast between island and mainland; and the journey is to be made in a ship. The Phæacians bring Odysseus home from Scheria and land him on the *island* at dawn.[9] When Telemachus, who has been visiting Menelaus at Sparta, is about to leave, he is offered by Menelaus as a guest-gift three

[7] *Od.* XIV. 96 *sqq.*:

ἦ γάρ οἱ ζωή γ' ἦν ἄσπετος· οὔ τινι τόσση
ἀνδρῶν ἠρώων, οὔτ' ἠπείροιο μελαίνης
οὔτ' αὐτῆς Ἰθάκης.

[8] *Od.* XVIII. 83 *sqq.*:

αἴ κέν σ' οὗτος νικήσῃ κρείσσων τε γένηται,
πέμψω σ' ἠπειρόνδε, βαλὼν ἐν νηὶ μελαίνῃ,
εἰς Ἔχετον βασιλῆα, βροτῶν δηλήμονα πάντων,
ὅς κ' ἀπὸ ῥῖνα τάμῃσι καὶ οὔατα νηλέϊ χαλκῷ,
μήδεα' τ' ἐξερύσας δώῃ κυσὶν ὠμὰ δάσασθαι.

[9] *Od.* XIII. 93 *sqq.*:

αὐτ' ἀστὴρ ὑπερέσχε φαάντατος, ὅς τε μάλιστα
ἔρχεται ἀγγέλων φάος ἠοῦς ἠριγενείης,
τῆμος δὴ νήσῳ προσεπίλνατο ποντοπόρος νηῦς.

horses and a polished chariot. These he declines on the ground that none of the *islands* is suitable for driving horses, and Ithaca least of all.[10] This definite inclusion of Ithaca among the islands would seem to remove all doubt, if, indeed, any remains after a consideration of the preceding passages.

Ithaca is regularly characterized as *ἀμφίαλος*, *sea-girt*. Antinous says to Telemachus in the assembly: "May Zeus never make you king in sea-girt Ithaca."[11]

2. Ithaca belonged to the territory of the Cephallenians, of whom Laertes was king.[12] The seat of his kingdom must have been Ithaca, as he continued to reside in the island, and the palace of Odysseus, his son who succeeded him, was in the city of Ithaca. The territory included Ithaca, Neriton, Crocyleia, Aegilips, Zacynthus, Samos, part of the mainland, and "the land opposite."[13] The forces of these countries, in twelve ships, were led to the war at Troy by Odysseus.[14]

[10] *Od.* IV. 607 *sq.*:

οὐ γάρ τις νήσων ἱππήλατος οὐδ' ἐυλείμων,
αἵ θ' ἁλὶ κεκλίαται· Ἰθάκη δέ τε καὶ περὶ πασέων.

[11] *Od.* I. 386 *sq.*:

μὴ σέ γ' ἐν ἀμφιάλῳ Ἰθάκῃ βασιλῆα Κρονίων
ποιήσειεν, ὅ τοι γενεῇ πατρώιόν ἐστιν.

Other passages are: *Od.* I. 395; *Od.* I. 401; *Od.* II. 293; *Od.* XXI. 252. For corroborative evidence see: *Od.* I. 280; *Od.* XXIV. 419; *Od.* I. 173; *Od.* XIV. 187; *Od.* XVI. 57; *Od.* XVI. 224; *Od.* I. 245 *sqq.*

[12] *Od.* XXIV. 376 *sqq.*:

αἱ γάρ, Ζεῦ τε πάτερ καὶ Ἀθηναίη καὶ Ἄπολλον,
οἷοι Νήρικον εἷλον, ἐυκτίμενον πτολίεθρον,
ἀκτὴν ἠπείροιο, Κεφαλλήνεσσιν ἀνάσσων.

[13] *ἤπειρον* in the passage below in all probability refers to Acarnania, and *ἀντιπέραια* to the coast of the Peloponnesus across the mouth of the Corinthian gulf from Acarnania.

[14] *Il.* II. 631 *sqq.*:

αὐτὰρ Ὀδυσσεὺς ἦγε Κεφαλλῆνας μεγαθύμους,
οἱ ῥ' Ἰθάκην εἶχον καὶ Νήριτον εἰνοσίφυλλον,
καὶ Κροκύλεια' ἐνέμοντο καὶ Αἰγίλιπα τρηχεῖαν,
οἵ τε Ζάκυνθον ἔχον ἠδ' οἱ Σάμον ἀμφενέμοντο,
οἵ τ' ἤπειρον ἔχον ἠδ' ἀντιπέραια νέμοντο·
τῶν μὲν Ὀδυσσεὺς ἦρχε Διὶ μήτιν ἀτάλαντος·
τῷ δ' ἅμα νῆες ἕποντο δυώδεκα μιλτοπάρηοι.

3. As to the location of the island, some indications are given in the Homeric poems.

According to the Hymn to Pythian Apollo, Ithaca is visible from the west coast of Elis. A ship is sailing along the west coast of the Peloponnesus, under the direction of Apollo, bound for Delphi. It leaves Pylus and passes by Crouni Chalcis, and Dyme and along the shore of Elis, and makes for Pheræ. From this position appear under the clouds the steep mountain of Ithaca, Dulichium, Same, and woody Zacynthus.[15]

In the fifteenth book of the Odyssey, Athena appears to Telemachus during the night while he and Peisistratus are staying at the palace of Menelaus, and advises him to return home. She informs him that the bravest of the suitors are lying in wait for him in the strait between Ithaca and Samos to kill him, but encourages him with the information that they will not succeed in their design. She instructs him to keep his ship far from the islands, to sail at night, and, when he reaches the first point of Ithaca, to send his companions to the city and himself go immediately to the swineherd.[16] The purpose of these instructions is to enable him to

[15] *Hym. Pyth. Apol.* 240 (418) *sqq.*:

ἀλλ' οὐ πηδαλίοισιν ἐπείθετο νηῦς εὐεργής,
ἀλλὰ παρὲκ Πελοπόννησον πίειραν ἐκοῦσα
ᾖε' ὁδόν· πνοιῇ δὲ ἄναξ ἐκάεργος Ἀπόλλων
ῥηιδίως ἴθυν'· ἡ δὲ πρήσσουσα κέλευθον
Ἀρήνην ἵκανε καὶ Ἀργυφέην ἐρατεινήν,
καὶ Θρύον, Ἀλφειοῖο πόρον, καὶ εὔκτιτον Αἶπυ
καὶ Πύλον ἡμαθόεντα Πυληγενέας τ' ἀνθρώπους.
βῆ δὲ παρὰ Κρουνοὺς καὶ Χαλκίδα καὶ παρὰ Δύμην,
ἠδὲ παρ' Ἦλιδα δῖαν, ὅθι κρατέουσιν Ἐπειοί.
εὖτε Φερὰς ἐπέβαλλεν, ἀγαλλομένη Διὸς οὔρῳ,
καί σφιν ὑπὲκ νεφέων Ἰθάκης τ' ὄρος αἰπὺ πέφαντο,
Δουλίχιόν τε Σάμη τε καὶ ὑλήεσσα Ζάκυνθος.

[16] *Od.* XV. 1–39. Lines 33–39 are as follows:

ἀλλὰ ἑκὰς νήσων ἀπέχειν ἐυεργέα νῆα,
νυκτὶ δ' ὁμῶς πλείειν· πέμψει δέ τοι οὖρον ὄπισθεν
ἀθανάτων ὅς τίς σε φυλάσσει τε ῥύεταί τε.
αὐτὰρ ἐπὴν πρώτην ἀκτὴν Ἰθάκης ἀφίκηαι,
νῆα μὲν ἐς πόλιν ὀτρῦναι καὶ πάντας ἑταίρους,
αὐτὸς δὲ πρώτιστα συβώτην εἰσαφικέσθαι,
ὅς τοι ὑῶν ἐπίουρος, ὁμῶς δέ τοι ἥπια οἶδεν.

avoid the suitors by taking a route different from that by which they expect him to return. It is evident, therefore, from the injunction to avoid the islands, and from the position which the suitors choose to intercept him, that the usual route would be by way of the islands and the strait between Ithaca and Samos. If the islands referred to were named, and the position of Samos were known, we should have valuable information for the location of Ithaca. The route actually taken by Telemachus is, presumably, the one suggested by Athena; because he had followed her advice in preparing for the journey to Pylus and in making it, and because, as it turns out, he succeeded in avoiding the suitors. This route lies by way of Pheæ, along the coast of Elis, and thence to the Pointed Isles.[17]

Ithaca was situated near Samos, being separated from it by a strait only. This is clearly shown in the passage in which Antinous asks the suitors for a ship and twenty companions. He wishes to use them in intercepting Telemachus in the strait between Ithaca and Samos on his return from Pylus.[18] The same strait is referred to by Athena, who tells Telemachus that the bravest of the suitors lie in wait for him in the strait between Ithaca and Samos,[19] when she urges him to return home from the house of Menelaus. Across

[17] *Od.* XV. 295 *sqq.*:

[βὰν δὲ παρὰ Κρουνοὺς καὶ Χαλκίδα καλλιρέεθρον.]
δύσετό τ' ἠέλιος σκιόωντό τε πᾶσαι ἀγυιαί,
ἡ δὲ Φεὰς ἐπέβαλλεν ἐπειγομένη Διὸς οὖρῳ,
ἠδὲ παρ' Ἤλιδα δῖαν, ὅθι κρατέουσιν Ἐπειοί.
ἔνθεν δ' αὖ νήσοισιν ἐπιπροέηκε θοῇσιν,
ὁρμαίνων, ἤ κεν θάνατον φύγοι ἤ κεν ἁλώῃ.

[18] *Od.* IV. 669 *sqq.*:

ἀλλ' ἄγε μοι δότε νῆα θοὴν καὶ εἴκοσ' ἑταίρους,
ὄφρα μιν αὐτὸν ἰόντα λοχήσομαι ἠδὲ φυλάξω
ἐν πορθμῷ Ἰθάκης τε Σάμοιό τε παιπαλοέσσης,
ὡς ἂν ἐπισμυγερῶς ναυτίλλεται εἵνεκα πατρός.

[19] *Od.* XV. 28 *sqq.*:

μνηστῆρων σ' ἐπιτηδὲς ἀριστῆες λοχόωσιν
ἐν πορθμῷ Ἰθάκης τε Σάμοιό τε παιπαλοέσσης
ἱέμενοι κτεῖναι πρὶν πατρίδα γαῖαν ἱκέσθαι.

this strait a public ferry[20] plies between the city of Ithaca and some point on the island of Samos. It is by this ferry that Philœtius brings a heifer and goats to the suitors; for we are informed in *Od.* XX. 210,[21] that Odysseus had put him, while he was a small boy, in charge of the cattle in the land of the Cephallenians, and Samos is definitely included among the possessions of the Cephallenians.[22]

A suggestion as to the location of Ithaca is obtained from the distance the poet represents it to be from the west coast of the Peloponnesus. In the account of the journey of Telemachus from Ithaca to Pylus, the poet states definitely that it began after nightfall and ended at sunrise.[23] The return journey also seems to be made in one night. The sun set as the ship made for Pheæ, and rose again as Telemachus and his companions landed on Ithaca.[24]

[20] *Od.* XX. 185 *sqq.*:

τοῖσι δ' ἐπὶ τρίτος ἦλθε Φιλοίτιος ὄρχαμος ἀνδρῶν,
βοῦν στεῖραν μνηστῆρσιν ἄγων καὶ πίονας αἶγας·
πορθμῆες δ' ἄρα τούς γε διήγαγον, οἵ τε καὶ ἄλλους
ἀνθρώπους πέμπουσιν, ὅ τέ σφεας εἰσαφίκηται.

[21] *ὦ μοι ἔπειτ' Ὀδυσῆος ἀμύμονος, ὅς μ' ἐπὶ βουσὶν*
εἷσ' ἔτι τυτθὸν ἐόντα Κεφαλλήνων ἐνὶ δήμῳ.

[22] See p. 4 n. 14.

[23] *Od.* II. 388–434, and *Od.* III. 1 *sqq.* The following lines will suffice to prove the point:

388 *sq.* *δύσετό τ' ἠέλιος σκιόωντό τε πᾶσαι ἀγυιαί,*
καὶ τότε νῆα θοὴν ἅλαδ' εὔρυσε,
* * * * * * * *
434 *πανυχίη μέν ῥ' ἥ γε καὶ ἠῶ πεῖρε κέλευθον.*

Od. III. 1 *sq.* *ἠέλιος δ' ἀνόρυσε, λιπὼν περικαλλέα λίμνην,*
* * * * * * * *
οἱ δὲ Πύλον, Νηλῆος ἐυκτίμενον πτολίεθρον,
ἷξον·

[24] *Od.* XV. 296 *sq.*:

δύσετό τ' ἠέλιος σκιόωντό τε πᾶσαι ἀγυιαί
ἡ δὲ Φεὰς ἐπέβαλλεν ἐπειγομένη Διὸς οὖρῳ,

Od. XV. 495: *αἶψα γὰρ Ἠὼς ἦλθεν ἐύθρονος. οἱ δ' ἐπὶ χέρσου*
Τηλεμάχου ἕταροι λύον ἱστία, κὰδ δ' ἕλον ἱστὸν
καρπαλίμως, τὴν δ' εἰς ὅρμον προέρεσσαν ἐρετμοῖς.

So far as the relation of Ithaca to Elis is concerned, the following passages show that ready and easy communication and intimate relations existed between them, and the natural presumption is that they were reasonably near together. Noemon, an inhabitant of Ithaca, who has lent Telemachus a ship for his voyage to Pylus, is anxious to know when he will return, as he needs the ship to cross over to Elis. He has there twelve mares with mule colts, one of which he wishes to bring over and break.[25] Again, Pylus and Elis seem to be near. Eupeithes, father of the suitor Antinous, thinks Odysseus will probably flee to one of them after killing the suitors. He proposes, therefore, to pursue and attempt to capture him before he reaches either of these places.[26]

In the first part of the ninth book of the *Odyssey* we seem

[25] *Od.* IV. 632 *sqq.*:

> Ἀντίνο', ἦ ῥά τι ἴδμεν ἐνὶ φρεσίν, ἦε καὶ οὐκί,
> ὁππότε Τηλέμαχος νεῖτ' ἐκ Πύλου ἠμαθόεντος;
> νῆά μοι οἴχετ' ἄγων, ἐμὲ δὲ χρεὼ γίγνεται αὐτῆς
> Ἦλιδ' ἐς εὐρύχορον διαβήμεναι, ἔνθα μοι ἵπποι
> δώδεκα θήλειαι, ὑπὸ δ' ἡμίονοι ταλαεργοὶ
> ἀδμῆτες· τῶν κέν τιν' ἐλασσάμενος δαμασαίμην.

[26] *Od.* XXIV. 430 *sqq.*:

> ἀλλ' ἄγετε, πρὶν τοῦτον ἢ ἐς Πύλον ὧκα ἱκέσθαι
> ἢ καὶ ἐς Ἦλιδα δῖαν, ὅθι κρατέουσιν Ἐπειοί,
> ἴομεν· ἦ καὶ ἔπειτα κατηφέες ἐσσόμεθ' αἰεί.

According to *Od.* XXI. 15 *sqq.*, Odysseus went to Messenia, a country immediately south of Elis, to recover a debt the people owed him for sheep and herdsmen taken by them.

> τὼ δ' ἐν Μεσσήνῃ ξυμβλήτην ἀλλήλοιν
> οἴκῳ ἐν Ὀρτιλόχοιο δαΐφρονος. ἦ τοι Ὀδυσσεὺς
> ἦλθε μετὰ χρεῖος, τό ῥά οἱ πᾶς δῆμος ὄφελλεν
> μῆλα γὰρ ἐξ Ἰθάκης Μεσσήνιοι ἄνδρες ἄειραν
> νηυσὶ πολυκλήισι τριηκόσι' ἠδὲ νομῆας.

Elis is referred to in the passage in which Telemachus tells his mother that none of those that hold sway in Ithaca or in the islands toward Elis have power to prevent him from giving or denying the bow to whom he will.

Od. XXI. 344 *sqq.*:

> μῆτερ ἐμή, τόξον μὲν Ἀχαιῶν οὔ τις ἐμεῖο
> κρείσσων, ᾧ κ' ἐθέλω, δόμεναί, τε καὶ ἀρνήσασθαι,
> οὔθ' ὅσσοι κραναὴν Ἰθάκην κάτα κοιρανέουσιν,
> οὔθ' ὅσσοι νήσοισι πρὸς Ἦλιδος ἱπποβότοιο.

to have some definite information as to the location and aspect of the island. Odysseus, in telling his story to Alcinous, king of the Phæacians, by whom he is being entertained, says: "I dwell in Ithaca, far-seen. On it is Neriton, a mountain with waving foliage, imposing. Round about lie many islands very near to each other, Dulichium, Same, and wooded Zacynthus. Ithaca lies low, furthest to the West in the sea, while the others lie apart toward the East. It is rough, but a genial nurse."[27]

That the island belonged to a group is clearly shown in the passage from *Od.* IV. 607, quoted above (p. 4), where Telemachus gives his reason for declining a guest-gift from Menelaus, consisting of three horses and a chariot. The islands referred to are probably Dulichium, Same, and Zacynthus, as this group is mentioned in connection with Ithaca in *Od.* IX. 24, and in the Hymn to Pythian Apollo, 251.

That Ithaca was not very far from the mainland we may infer from the fact that Odysseus had herds and flocks there: twelve herds of cattle, the same number of flocks of sheep, as many droves of swine, and the same number of roving bands of goats.[28]

It is represented also as being on the way from Thesprotia to Dulichium. Odysseus as beggar tells his story to Eumæus, explaining how he reached Ithaca. He says that he was wrecked after passing Crete; that he drifted nine days and landed on the Thesprotian coast; then king Pheidon put

[27] *Od.* IX. 21 *sqq.*:

ναιετάω δ' Ἰθάκην ἐυδείελον· ἐν δ' ὄρος αὐτῇ
Νήριτον εἰνοσίφυλλον, ἀριπρεπές· ἀμφὶ δὲ νῆσοι
πολλαὶ ναιετάουσι μάλα σχεδὸν ἀλλήλῃσιν,
Δουλίχιόν τε Σάμη τε καὶ ὑλήεσσα Ζάκυνθος.
αὐτὴ δὲ χθαμαλὴ πανυπερτάτη εἰν ἁλὶ κεῖται
πρὸς ζόφον, αἱ δέ τ' ἄνευθε πρὸς ἠῶ τ' ἠέλιόν τε
τρηχεῖ', ἀλλ' ἀγαθὴ κουροτρόφος·

For discussion see chapter iii.

[28] *Od.* XIV. 100 *sqq.*:

δώδεκ' ἐν ἠπείρῳ ἀγέλαι· τόσα πώεα οἰῶν,
τόσσα συῶν συβόσια, τόσ' αἰπόλια πλατέ' αἰγῶν
βόσκουσι ξεῖνοί τε καὶ αὐτοῦ βώτορες ἄνδρες.

him on board a Thesprotian ship bound for Dulichium with orders to escort him to king Acastus; on their way the Thesprotians stopped at Ithaca, and, after binding him in the ship, landed and took a meal; meanwhile he escaped from the ship, swam to land, and got free from the Thesprotians, who had intended to sell him into slavery.[29]

Unfortunately the location of Dulichium is uncertain, although we have pretty full information about it in other respects: Acastus was king[30] of the land; Amphinomus, the leader of the suitors, who was specially pleasing to Penelope by reason of his intelligence, was from Dulichium;[31] from it came fifty-two suitors[32]—nearly as many as came from Same, Zacynthus, and Ithaca combined; and Meges led the forces from Dulichium and the Echinaes in forty ships to Troy.[33] Two views are held of the location of Dulichium, each supported by some evidence. One is that it is identical with Pale (Paliki), the western peninsula of Cephallenia, and that, though once an island, it became joined to Cephallenia. The present appearance of the island makes this very improbable, as the isthmus is 1,300 meters wide and 185 meters high. We have, however, a statement from Strabo[34] that "Paleis is called Dulichium by Homer, as Pherecydes writes;" and Pausanias[35] says that the Paleans, one of the four divisions of the Cephallenians, dedicated a statue of an Elean, Timoptolis, son of Lampis; and that these Paleans were formerly called Dulichians. The scholion to *Od.* I. 245[36] represents Dulichium as an island opposite Cephallenia (Δουλιχίῳ] *νήσῳ κατὰ τὴν*

[29] *Od.* XIV. 314 *sqq.*

[30] *Od.* XIV. 336.

[31] *Od.* XVI. 393 *sqq.*

[32] *Od.* XVI. 247.

[33] *Π.* II. 625 *sqq.*

[34] Strabo, X. 2, 14: Παλεῖς Δουλίχιον ὑφ' Ὁμήρου λέγονται, ὡς γράφει Φερεκύδης.

[35] Pausanias, VI. 15, 7: ἀνέθεσαν δὲ καὶ Ἠλεῖον ἄνδρα Τιμόπτολιν Λάμπιδος Παλεῖς, ἡ τετάρτη Κεφαλλήνων μοῖρα. οὗτοι δὲ οἱ Παλεῖς, ἐκαλοῦντο Δουλιχιεῖς τὰ ἀρχαιότερα.

[36] *Od.* I. 245 *sqq.*:

ὅσσοι γὰρ νήσοισιν ἐπικρατέουσιν ἄριστοι,
Δουλιχίῳ τε Σάμῃ τε καὶ ὑλήεντι Ζακύνθῳ,
ἠδ' ὅσσοι κραναὴν Ἰθάκην κάτα κοιρανέουσιν,
τόσσοι μητέρ' ἐμὴν μνᾶνται, τρύχουσι δὲ οἶκον.

Κεφαλληνίαν). The scholion to *Od.* XIV. 397[37] explains Dulichium as a city of Cephallenia (Δουλίχιον] πόλις τῆς Κεφαλληνίας). Hesychius also refers to it as a city of Cephallenia (Δουλίχιον, πόλις Κεφαλληνίας). Frazer, *Pausanias*, IV. p. 47, says, "The island of Cephallenia was divided into four petty independent states, each with its own capital. These towns were Same, Pronni, Crane, and Pale. This subdivision of the island explains its political insignificance in antiquity. The name of Pale is still retained in the modern Paliki, the name of the peninsula on which Pale stood." A scholion to *Il.* II. 625[38] represents it as an island in front of Cephallenia. The other view in regard to Dulichium is that it lay off the mainland at the mouth of the Achelous river, or further south. Homer mentions Dulichium with the Echinades when enumerating the forces led by Meges to Troy.[39] The Echinades were at the mouth of the Achelous. The scholiast to the same passage states that Dulichium was one of the Echinades.[40] Strabo also regards it as one of the Echinades; commenting on *Il.* II. 625, οἳ δ' ἐκ Δουλιχίοιο Ἐχινάων θ' ἱεράων, he says: καὶ αὐτοῦ τοῦ Δουλιχίου τῶν Ἐχινάδων ὄντος. A probable explanation of the non-appearance of this island in that region is furnished by Herodotus,[41] who states that the Achelous river flowing through Acarnania and emptying into the sea has already joined half of the Echinades islands to the main-

[37] *Od.* XIV. 397:

ἕσσας με χλαῖνάν τε χιτῶνά τε εἵματα πέμψαι
Δουλίχιόνδ' ἰέναι, ὅθι μοι φίλον ἔπλετο θυμῷ.

[38] Δουλίχιον νῆσος πρὸ τῆς Κεφαλληνίας· αἱ δὲ Ἐχινάδες νῆσοί εἰσι τῆς Ἀκαρνανίας, παρὰ ταῖς ἐκβολαῖς τοῦ Ἀχελῴου ποταμοῦ, ἐν αἷς οἱ κατοικοῦντες καλοῦνται Ἐπειοί.

[39] *Il.* II. 625: οἳ δ' ἐκ Δουλιχίοιο Ἐχινάων θ' ἱεράων
νήσων, αἳ ναίουσι πέρην ἁλὸς Ἠλίδος ἄντα,
τῶν αὖθ' ἡγεμόνευε Μέγης ἀτάλαντος Ἄρηι.

[40] Δουλιχίοιο] μία τῶν Ἐχινάδων τὸ Δουλίχιον. ὅτι δὲ πλησίον Πελοποννήσου δηλοῖ Τηλέμαχος πρὸς Νέστορα ἀπιών.

[41] Herod. II. 10: τῶν ἐγὼ φράσαι ἔχω οὐνόματα καὶ ἄλλων καὶ οὐκ ἥκιστα Ἀχελῴου, ὃς ῥέων δι' Ἀκαρνανίης καὶ ἐξιεὶς ἐς θάλασσαν τῶν Ἐχινάδων νήσων τὰς ἡμισέας ἤδη ἤπειρον πεποίηκε.

land. Another location for the island is suggested by Dodwell in his *Tour in Greece* I. 108. He says: "In my passage from Zacynthus to the coast of Ætolia we sailed over a shoal about eight feet below the surface of the water. The captain pointed it out to me and said, '*ἐδῶ εἶναι Δουλείχα*,' (here is Douleicha)."

4. Besides this information as to the island we have some general descriptions of it.

When Odysseus lands, Athena, in the form of a young shepherd, meets him, and, in reply to his question as to what land he has reached, says that he must be simple-minded or else must have come from afar to ask what land it is; that it is not without fame; that many know it, both those who live toward the East and those who live toward the West; that its fame has reached Troy, which is far away from Achæa.[42] She then gives the characteristics of the island: It has not good meadows nor wide driving courses, but supports goats and cattle, is rough (*τρηχεῖα*), rocky (*κραναή*), far-seen (*εὐδείελος*), not wide, a kindly nurse (*ἀγαθὴ κουροτρόφος*), not so poor (*οὐδὲ λίην λυπρή*), fertile (*πίων*), has abundant grain, wine, all sorts of wood, perennial springs, rain and dew, and produces figs, grapes, olives, pears, and flowers.[43] We hear

[42] *Od.* XIII. 237 *sqq.*:

νήπιός εἰς, ὦ ξεῖν', ἢ τηλόθεν εἰλήλουθας,
εἰ δὴ τήνδε γε γαῖαν ἀνείρεαι· οὐδέ τι λίην
οὕτω νώνυμός ἐστιν· ἴσασι δέ μιν μάλα πολλοί,
ἠμὲν ὅσοι ναίουσι πρὸς ἠῶ τ' ἠέλιόν τε
ἠδ' ὅσσοι μετόπισθε ποτὶ ζόφον ἠερόεντα
* * * * * * * *
248 *τῷ τοι, ξεῖν', Ἰθάκης γε καὶ ἐς Τροίην ὀνομ' ἵκει,*
τήν περ τηλοῦ φασιν Ἀχαιΐδος ἔμμεναι αἴης.

[43] *Od.* XIII. 242 *sqq.*:

ἦ τοι μὲν τρηχεῖα καὶ οὐχ ἱππήλατός ἐστιν,
οὐδὲ λίην λυπρή, ἀτὰρ οὐδ' εὐρεῖα τέτυκται.
ἐν μὲν γὰρ οἱ σῖτος ἀθέσφατος, ἐν δέ τε οἶνος
γίγνεται· αἰεὶ δ' ὄμβρος ἔχει τεθαλυῖά τ' ἐέρση.
αἰγίβοτος δ' ἀγαθὴ καὶ βούβοτος· ἔστι μὲν ὕλη
παντοίη, ἐν δ' ἀρδμοὶ ἐπητανοὶ παρέασιν.

Od. XXIV. 246 *sq.*:

οὐ φυτόν, οὐ συκῆ, οὐκ ἄμπελος, οὐ μὲν ἐλαίη,
οὐκ ὄγχνη, οὐ πρασιή τοι ἄνευ κομιδῆς κατὰ κῆπον.

elsewhere that the part of the island between Phorcys harbor and Eumæus's place was rough and hilly,[44] as also that between the latter and the city.[45]

There are two mountains in Ithaca, Neion and Neriton.[46] Of their location we are not fully informed. Neion has at its foot Reithron harbor[47] and the city of Ithaca,[48] Neriton is visible from Phorcys harbor; Athena, as a shepherd boy, points it out to Odysseus from there.[49] Both mountains are wooded.

There are three harbors, besides the place where Telemachus landed on his return from Pylus, to which no name is

Od. IV. 605 *sq.*:

ἐν δ' Ἰθάκῃ οὔτ' ἄρ δρόμοι εὐρέες οὔτε τι λειμών·
αἰγίβοτος, καὶ μᾶλλον ἐπήρατος ἱπποβότοιο.

Many of the epithets here applied are used elsewhere, as: τρηχεῖα, *Od.* IX. 27; κραναή, *Od.* I. 247; *Il.* III. 201; *Od.* XV. 510; XVI. 124; XXI. 346. πίων, *Od.* XIV. 329; XIX. 399. εὐδείελος, *Od.* II. 167; IX. 21; XIII. 212; XIII. 325.

[44] *Od.* XIV. 1 *sq.*:

αὐτὰρ ὁ ἐκ λιμένος προσέβη τρηχεῖαν ἀταρπὸν
χῶρον ἀν' ὑλήεντα δι' ἄκριας.

[45] *Od.* XVII. 195 *sq.*:

ὁδὸς δέ μοι, εἴ ποθί τοι ῥόπαλον τετμημένον ἔστιν,
σκηρίπτεσθ', ἐπεὶ ἦ φάτ' ἀρισφαλέ' ἔμμεναι οὐδόν.
204 ἀλλ' ὅτε δὴ στείχοντες ὁδὸν κάτα παιπαλόεσσαν
ἄστεος ἐγγὺς ἔσαν.

[46] *Od.* IX. 21 *sq.* Odysseus tells Alcinous who he is:

ναιετάω δ' Ἰθάκην εὐδείελον· ἐν δ' ὄρος αὐτῇ
Νήριτον εἰνοσίφυλλον, ἀριπρεπές.

Schol. *Il.* II. 632: Νήριτον] ὄρος Ἰθάκης, εἰνοσίφυλλον δὲ καὶ πολύδενδρον, ἐξ οὗ κατήνεμον καὶ ὑψηλόν· ἔνοσις γὰρ κίνησις.

[47] *Od.* I. 185 *sq.* Athena as Mentes tells Telemachus she has left her ship in Reithron harbor at the foot of woody Neion:

νῆυς δέ μοι ἥδ' ἕστηκεν ἐπ' ἀγροῦ νόσφι πόληος,
ἐν λιμένι Ῥείθρῳ ὑπὸ Νηίῳ ὑλήεντι.

[48] *Od.* III. 81. Telemachus tells Nestor he is from Ithaca at the foot of Neion:

ἡμεῖς ἐξ Ἰθάκης ὑπονηίου εἰλήλουθμεν.

[49] *Od.* XIII. 351:

τοῦτο δὲ Νήριτόν ἐστιν, ὄρος καταειμένον ὕλῃ.

given;[50] these are: the city harbor, Reithron, and Phorcys harbor.

Athena launches the ship for Telemachus for his voyage to Pylus, and stations it at the extremity of the harbor.[51] Telemachus, on his return from Pylus, after landing at the nearest point, orders his men to sail the black ship to the city, informing them that he is going to visit the farms and the herdsmen.[52] Telemachus's ship enters the deep harbor and is beached.[53] When the suitors are preparing to go in search of Telemachus, they make ready their boat, launch it, and anchor in the roadstead. They then take their supper and wait for night to come on.[54] Eumæus, leaving the city to go home, reaches Hermes hill, from which he sees the ship of the suitors entering the city harbor, after failing in their attempt to intercept Telemachus.[55] Amphinomus sees the same ship

[50] *Od.* XV. 495 *sqq.*:

αἶψα γὰρ Ἠὼς ἦλθεν ἐύθρονος. οἱ δ' ἐπὶ χέρσου
Τηλεμάχου ἑταῖροι λύον ἱστία, κὰδ δ' ἕλον ἱστὸν
καρπαλίμως, τὴν δ' εἰς ὅρμον προέρεσσαν ἐρετμοῖς.
ἐκ δ' αὐνὰς ἔβαλον, κατὰ δὲ πρυμνήσι' ἔδησαν·
ἐκ δὲ καὶ αὐτοὶ βαῖνον ἐπὶ ῥηγμῖνι θαλάσσης,
δεῖπνόν τ' ἐντύνοντο κεροῦντό τε αἴθοπα οἶνον.

[51] *Od.* II. 388 *sqq.*:

δύσετό τ' ἠέλιος σκιόωντό τε πᾶσαι ἀγυιαί,
καὶ τότε νῆα θοὴν ἅλαδ' εἵρυσε, πάντα δ' ἐν αὐτῇ
ὅπλ' ἐτίθει, τά τε νῆες ἐύσσελμοι φορέουσιν.
στῆσε δ' ἐπ' ἐσχατιῇ λιμένος, περὶ δ' ἐσθλοὶ ἑταῖροι
ἀθρόοι ἠγερέθοντο· θεὰ δ' ὄτρυνεν ἕκαστον.

[52] *Od.* XV. 503 *sq.*:

ὑμεῖς μὲν νῦν ἄστυδ' ἐλαύνετε νῆα μέλαιναν,
αὐτὰρ ἐγὼν ἀγροὺς ἐπιείσομαι ἠδὲ βοτῆρας.

[53] *Od.* XVI. 324 *sq.*:

οἱ δ' ὅτε δὴ λιμένος πολυβενθέος ἐντὸς ἵκοντο,
νῆα μὲν οἵ γε μέλαιναν ἐπ' ἠπείροιο ἔρυσσαν.

[54] *Od.* IV. 785 *sq.*:

ὑψοῦ δ' ἐν νοτίῳ τὴν γ' ὥρμισαν, ἐκ δ' ἔβαν αὐτοί·
ἔνθα δὲ δόρπον ἕλοντο, μένον δ' ἐπὶ ἕσπερον ἐλθεῖν.

[55] *Od.* XVI. 471 *sqq.*:

ἤδη ὑπὲρ πόλιος, ὅθι θ' Ἑρμαιος λόφος ἐστίν,
ἦα κιών, ὅτε νῆα θοὴν ἰδόμην κατιοῦσαν
ἐς λιμέν' ἡμέτερον.

within the deep harbor as he turns in his place before the aule of the palace.[56]

Reithron is the harbor where Athena, as Mentes, landed. It is on the edge of the fields, outside of the city, and at the foot of woody Neion.[57]

Phorcys harbor is that at which Odysseus was landed by the Phæacians who brought him from Scheria, and is thus described by the poet: "Now in the land of Ithaca there is a certain harbor sacred to Phorcys, the old man of the sea. Here two projecting, jagged cliffs slope inward toward the harbor and break the heavy waves raised by wild winds without. Inside, without a cable, ride the well-benched ships when once they reach the roadstead. Just at the harbor's head a leafy olive stands, and near it a pleasant darksome cave sacred to nymphs, called Naiads."[58] Athena, as a shepherd, points out to Odysseus the harbor[59] and the olive tree to convince him that the land is Ithaca.

In connection with the harbor may be noted the nymphs' cave. "Just at the harbor's head a leafy olive stands, and

[56] *Od.* XVI. 351 *sqq.*:

οὔ πω πᾶν εἴρητο, ὅτ' Ἀμφίνομος ἵξε νῆα,
στρεφθεὶς ἐκ χώρης, λιμένος πολυβενθέος ἐντός,
ἱστία τε στέλλοντας ἐρετμά τε χερσὶν ἔχοντας.

[57] *Od.* I. 185 *sq.*:

νηῦς δέ μοι ἥδ' ἕστηκεν ἐπ' ἀγροῦ νόσφι πόληος,
ἐν λιμένι Ῥείθρῳ ὑπὸ Νηΐῳ ὑλήεντι.

[58] *Od.* XIII. 96 *sqq.*:

Φόρκυνος δέ τις ἔστι λιμὴν ἁλίοιο γέροντος
ἐν δήμῳ Ἰθάκης, δύο δὲ προβλῆτες ἐν αὐτῷ
ἀκταὶ ἀπορρῶγες, λιμένος ποτιπεπτηυῖαι,
αἵ τ' ἀνέμων σκεπόωσι δυσαήων μέγα κῦμα
ἔκτοθεν· ἔντοσθεν δέ τ' ἄνευ δεσμοῖο μένουσιν
νῆες ἐύσσελμοι, ὅτ' ἂν ὅρμου μέτρον ἵκωνται.
αὐτὰρ ἐπὶ κρατὸς λιμένος τανύφυλλος ἐλαίη,
ἀγχόθι δ' αὐτῆς ἄντρον ἐπήρατον ἠεροειδές,
ἱρὸν νυμφάων, αἳ νηιάδες καλέονται.

The translation in the text is from Palmer's *Odyssey*.

[59] *Od.* XIII. 345 *sq.*:

Φόρκυνος μὲν δδ' ἐστὶ λιμὴν ἁλίοιο γέροντος
ἥδε δ' ἐπὶ κρατὸς λιμένος τανύφυλλος ἐλαίη.

near it a pleasant darksome cave sacred to nymphs, called Naiads. Within the cave are bowls and jars of stone, and here bees hive their honey. Long looms of stone are here, where nymphs weave purple robes, a marvel to behold. Here are everflowing springs. The cave has double doors; one to the north, accessible to men; one to the south, for gods. By this men do not pass; it is the immortals' entrance."[60] The additional information is given later that the cave is arched, and that Odysseus had offered there many perfect hecatombs to the nymphs.[61]

Only one city is mentioned as existing in the island. It in all probability extended to the harbor, and the palace seems to have been near the shore. When the assembly breaks up in which Telemachus had announced his intention to go to Pylus to seek information about his father, the Ithacans go to their homes, the suitors to the palace of Odysseus, but he walks to the shore of the sea and prays to Athena.[62] Telemachus and his companions carry the provisions to the

[60] *Od.* XIII. 102 *sqq.*:

αὐτὰρ ἐπὶ κρατὸς λιμένος τανύφυλλος ἐλαίη,
ἀγχόθι δ' αὐτῆς ἄντρον ἐπήρατον ἠεροειδές,
ἱρὸν νυμφάων, αἳ νηιάδες καλέονται.
ἐν δὲ κρητῆρές τε καὶ ἀμφιφορῆες ἔασιν
λάινοι· ἔνθα δ' ἔπειτα τιθαιβώσσουσι μέλισσαι.
ἐν δ' ἱστοὶ λίθεοι περμήκεες, ἔνθα τε νύμφαι
φάρε' ὑφαίνουσιν ἀλιπόρφυρα, θαῦμα ἰδέσθαι·
ἐν δ' ὕδατ' αἰενάοντα. δύω δέ τέ οἱ θύραι εἰσίν,
αἱ μὲν πρὸς Βορέαο καταιβαταὶ ἀνθρώποισιν,
αἱ δ' αὖ πρὸς Νότου εἰσὶ θεώτεραι, οὐδέ τι κείνῃ
ἄνδρες ἐσέρχονται, ἀλλ' ἀθανάτων ὁδός ἐστιν.

The translation is Palmer's.

[61] *Od.* XIII. 349 *sq.*:

τοῦτο δέ τοι σπέος ἐστὶ κατηρεφές, ἔνθα σὺ πολλὰς
ἕρδεσκες νύμφῃσι τελήεσσας ἑκατόμβας·

[62] *Od.* II. 257 *sqq.*:

ὣς ἄρ' ἐφώνησεν, λῦσεν δ' ἀγορὴν αἰψηρήν.
οἱ μὲν ἄρ' ἐσκίδναντο ἑὰ πρὸς δώματ' ἕκαστος,
μνηστῆρες δ' ἐς δώματ' ἴσαν θείου Ὀδυσῆος.
Τηλέμαχος δ' ἀπάνευθε κιὼν ἐπὶ θῖνα θαλάσσης
χεῖρας νιψάμενος πολιῆς ἁλὸς εὔχετ' Ἀθήνῃ·

ship when he is preparing to start for Pylus. These consist of twelve jars of wine and twenty measures of barley meal in sacks.[63]

The harbor is visible from the palace; for Amphinomus, seated among the other suitors in front of the aule, sees the suitors' ship in the harbor,[64] whereupon they at once rise and go to the shore.[65] The city was on an elevation above the sea, as the passage *Od.* XVI. 343 *sqq.* indicates; but it can not have been a very high elevation, since the city was at the foot of Mt. Neion,[66] as Telemachus tells Nestor, and was also below Hermes hill, for Eumæus says he was "already above the city where Hermes hill is when he saw the ship entering the harbor."[67]

There was evidently an agora or assembly place; Telema-

[63] *Od.* II. 349 *sq.*:

μαῖ', ἄγε δή μοι οἶνον ἐν ἀμφιφορεῦσιν ἄφυσσον
ἡδύν, * * * * * * *
353 δώδεκα δ' ἕμπλησον καὶ πώμασιν ἄρσον ἅπαντας.
ἐν δέ μοι ἄλφιτα χεῦον ἐυρραφέεσσι δοροῖσιν·
εἴκοσι δ' ἔστω μέτρα μυληφάτου ἀλφίτου ἀκτῆς.
* * * * * * * * *
414 οἱ δ' ἄρα πάντα φέροντες ἐυσσέλμῳ ἐπὶ νηὶ
κάτθεσαν, ὡς ἐκέλευσεν Ὀδυσσῆος φίλος υἱός.

[64] *Od.* XVI. 343 *sqq.*:

ἐκ δ' ἦλθον μεγάροιο παρὲκ μέγα τειχίον αὐλῆς,
αὐτοῦ δὲ προπάροιθε θυράων ἑδριόωντο.
τοῖσιν δ' Εὐρύμαχος Πολύβου πάις ἦρχ' ἀγορεύειν·
* * * * * * * * *
351 οὔ πω πᾶν εἴρητο, ὅτ' Ἀμφίνομος ἷδε νῆα,
στρεφθεὶς ἐκ χώρης, λιμένος πολυβενθέος ἐντός,
ἱστία τε στέλλοντας ἐρετμά τε χερσὶν ἔχοντας.

[65] *Od.* XVI. 358:

ὣς ἔφαθ', οἱ δ' ἀνστάντες ἔβαν ἐπὶ οἶνα θαλάσσης.

[66] *Od.* III. 81. Telemachus says to Nestor:

ἡμεῖς ἐξ Ἰθάκης ὑπονηίου εἰλήλουθμεν.

[67] *Od.* XVI. 471 *sqq.*:

ἤδη ὑπὲρ πόλιος, ὅθι θ' Ἑρμαιος λόφος ἐστίν,
ἦα κιών, ὅτε νῆα θοὴν ἰδόμην κατιοῦσαν
ἐς λιμέν' ἡμέτερον.

chus calls an assembly to urge the suitors to go elsewhere and feast;[68] the suitors assemble in the agora after the arrival of those who went in search of Telemachus;[69] and the people of Ithaca assemble there after the death of the suitors.[70]

Near the city is a spring, stone-built, of beautiful stream, from which the townspeople get water. It is at this spring that Eumæus and Odysseus meet Melanthius, the goatherd. It was built by Ithacus, Neritus, and Polyctor. Round about is a grove of poplar trees. Cold water flows down from a high rock on which is an altar to the nymphs where travelers make offerings to them.[71]

Not far from the city, presumably, is located Hermes hill, from which Eumæus on his way home sees the ship of the suitors entering the city harbor.[72] It is just above the city.

Laertes's farm is in the country at a distance from the city, as we learn in an account of Odysseus's visit to his father.[73] This statement is corroborated by the fact that he does not come to town, but apart on his farm suffers grief attended by Sikele.[74] As to the location of the farm in the island, it seems not to be on the way from Eumæus's establishment to the city. When Eumæus is about to start to the

[68] *Od.* II. 6 *sqq.* [69] *Od.* XVI. 361 *sqq.* [70] *Od.* XXIV. 420.

[71] *Od.* XVII. 204 *sqq.*:

ἀλλ' ὅτε δὴ στείχοντες ὁδὸν κάτα παιπαλόεσσαν
ἄστεος ἐγγὺς ἔσαν καὶ ἐπὶ κρήνην ἀφίκοντο
τυκτὴν καλλίροον, ὅθεν ὑδρεύοντο πολῖται·
τὴν ποίησ' Ἴθακος καὶ Νήριτος ἠδὲ Πολύκτωρ·
ἀμφὶ δ' ἄρ' αἰγείρων ὑδατοτρεφέων ἦν ἄλσος
πάντοσε κυκλοτερές, κατὰ δὲ ψυχρὸν ῥέεν ὕδωρ
ὑψόθεν ἐκ πέτρης· βωμὸς ἐφύπερθε τέτυκτο
νυμφάων, ὅθι πάντες ἐπιρρέζεσκον ὁδῖται·

[72] See note 55.

[73] *Od.* XXIV. 211 *sq.*:

ἐν δὲ γυνὴ Σικελὴ γρῆυς πέλεν, ἥ ῥα γέροντα
ἐνδυκέως κομέεσκεν ἐπ' ἀγροῦ νόσφι πόληος.

[74] *Od.* I. 188 *sqq.*:

εἴ περ τε γέροντ' εἴρηαι ἐπελθὼν
Λαέρτην ἥρωα, τὸν οὐκέτι φασὶ πόλινδε
ἔρχεσθ', ἀλλ' ἀπάνευθεν ἐπ' ἀγροῦ πήματα πάσχειν
γρηῒ σὺν ἀμφιπόλῳ.

city to inform Penelope of the arrival of her son, he asks Telemachus whether he shall, on the same journey, carry the information to Laertes also. Telemachus replies that he is to return after delivering his message at the palace and not go wandering over the country after Laértes, but have Penelope send one of the maidservants to deliver the information to Laertes secretly.[75] For some reason or other, Telemachus can not spare more of the time of Eumæus than is required to go to the palace and return. The fact, therefore, that, although he is anxious for Laertes to be informed of his return, he orders Eumæus to go to the palace and inform Penelope, and not to go to Laertes's farm, but to have Penelope send a maidservant secretly to carry the message to him, necessarily implies that it would have taken additional time for Eumæus to go there. Hence Laertes's farm is either beyond the city from Eumæus's place or else at a considerable distance off the way from one to the other.

Another place important for this discussion is the island Asteris. It is described by Homer as a small, rocky island, in the midst of the strait between Ithaca and Samos, with double harbors.[76] Here the suitors lay in wait for Telemachus, the watchers sitting upon the windy heights by day posted in close succession. At night they did not remain on land but

[75] *Od.* XVI. 137 *sqq.*:

ἀλλ' ἄγε μοι τόδε εἰπὲ καὶ ἀτρεκέως κατάλεξον,
εἰ καὶ Λαέρτῃ αὐτὴν ὁδὸν ἄγγελος ἔλθω
δυσμόρῳ,
* * * * * * * * *
150 ἀλλὰ σύ γ' ἀγγείλας ὀπίσω κίε, μηδὲ κατ' ἀγροὺς
πλάζεσθαι μετ' ἐκεῖνον· ἀτὰρ πρὸς μητέρα εἰπεῖν
ἀμφίπολον ταμίην ὀτρυνέμεν ὅττι τάχιστα
κρύβδην· κείνη γάρ κεν ἀπαγγείλειε γέροντι.

[76] *Od.* IV. 844 *sqq.*:

ἔστι δέ τις νῆσος μέσσῃ ἁλὶ πετρήεσσα,
μεσσηγὺς Ἰθάκης τε Σάμοιό τε παιπαλοέσσης,
Ἀστερίς, οὐ μεγάλη· λιμένες δ' ἔνι ναύλοχοι αὐτῇ
ἀμφίδυμοι· τῇ τόν γε μένον λοχόωντες Ἀχαιοί.

sailed their swift ship on the sea, lying in wait to seize and slay Telemachus.[77]

[77] *Od.* XVI. 365 *sqq.*:

> ἤματα μὲν σκοποὶ ἷζον ἐπ' ἄκριας ἠνεμοέσσας
> αἰὲν ἐπασσύτεροι· ἅμα δ' ἠελίῳ καταδύντι
> οὔ ποτ' ἐπ' ἠπείρου νύκτ' ἄσαμεν, ἀλλ' ἐνὶ πόντῳ
> νηὶ θοῇ πλείοντες ἐμίμνομεν Ἠῶ δῖαν
> Τηλέμαχον λοχόωντες, ἵνα φθίσωμεν ἕλόντες
> αὐτόν·

Cf. Od. IV. 669 *sqq.*, where Antinous asks for a swift ship and twenty companions to lie in wait for Telemachus in the strait between Ithaca and Samos:

> ἀλλ' ἄγε μοι δότε νῆα θοὴν καὶ εἴκοσ' ἑταίρους,
> ὄφρα μιν αὐτὸν ἰόντα λοχήσομαι ἠδὲ φυλάξω
> ἐν πορθμῷ Ἰθάκης τε Σάμοιό τε παιπαλοέσσης,

and *Od.* XV. 28 *sqq.* (above, p. 6), where Athena tells Telemachus that the bravest of the suitors lie in wait for him in the strait between Ithaca and Samos, eager to kill him before he reaches his native land:

> μνηστήρων σ' ἐπιτηδὲς ἀριστῆες λοχόωσιν
> ἐν πορθμῷ Ἰθάκης τε Σάμοιό τε παιπαλοέσσης
> ἱέμενοι κτεῖναι πρὶν πατρίδα γαῖαν ἱκέσθαι.

CHAPTER II

Leucas

We shall now consider whether the island Leucas fulfils the conditions of Homeric Ithaca as presented in the Homeric poems.

Leucas[78] contains about 110 square miles, and is 30 miles from north to south, and 10 miles from east to west. It is a mountainous country, some of its peaks rising to the height of 3,500 feet. On the western side its coast is steep, high, and rocky, furnishing no harbor whatever, and ending in the famous promontory called the Leucadian Rock. On the southern side the coast is steep and rough, but there are several inlets or bays: Vasiliki, Skydi, Sybota, and Ruda. The eastern coast at its southern end is steep and mountainous, but is indented by a large bay, that of Vlicho, with a narrow entrance. Along this end of the coast stretches a line of islands. The northern end of the east coast is low, and is joined to the mainland.[79] This portion of Leucas is described in detail by E. Oberhummer[80] as follows:

"Ungefähr in der Mitte des Nordrandes von Leukadien, 2 km. westlich von der modernen Stadt Leukas, zieht sich ein 200–300 m. breiter, ganz flacher, aus Sand und Kalksteingrus gebildeter Landstreifen über 2 km. nach NNO, dann mit scharfer Ecke umbiegend 3 km. nach OSO bis zur Festung von Sta. Maura, wo der Zusammenhang durch zwei Lagune und Meer verbindende Kanäle unterbrochen ist. Jenseits der Festung nimmt der nunmehr bedeutend schmälere Streifen, hier Plaka genannt, wieder NNO-Richtung an und läuft 3½ km. lang der Küste des Festlands parallel. Zwischen dieser Nehrung und dem festen Lande von Akarnanien und Leukadien dehnt sich, nach Süden schmäler werdend, eine Lagune aus, welche im Durchschnitt höchstens ½ m. tief ist und schlammigen Grund zeigt, so dass nur ganz flache Kähne dieselbe befahren können.

[78] J. Partsch, *Die Insel Leukas*, p. 3. [79] See Plates II and III.

[80] E. Oberhummer, *Akarnanien, Ambrakia, Amphilochien, Leukas im Altertum*, pp. 7 *sqq*.

Ein Dammweg und unmittelbar daran ein für Boote gut fahrbarer Kanal verbindet Festung und Stadt. Ein zweiter Kanal durchzieht von der Festung aus die Lagune nach Süden bis zur engsten Stelle zwischen Paläo-Chalia, einem kleinen Ort auf einem Felshügel am akarnanischen Ufer, und der Landspitze, welche früher das Fort Alexandros trug. Südlich davon nimmt die Schiffbarkeit des Wassers rasch zu und erreicht unterhalb des Forts St. Georg, wo die arkarnanische Küste nach Osten zurücktritt, bereits 4 Faden. An dieser Stelle sollen nach der englischen Karte noch Spuren eines antiken Molo vorhanden sein; ich kann ihre Existenz nicht verbürgen, obgleich sich nach persönlichen Erkundigungen von mir die Angabe zu bestätigen scheint. Die Entfernungen betragen in Luftlinie von der Festung und somit vom offenen Meere im Norden bis Paläo-Chalia 4 km., von hier bis zur Linie des erwähnten Molo, die den Beginn des offenen Meeres im Süden bezeichnet, 1½ km."

The interior of the island is mountainous, the ranges extending in general from north to south, beginning at Hagios Joannis, which rises steep out of the sea, but is not very high. Further south is Megala Rachi with an elevation of about 350 meters. The ancient road led from the northeastern part of Leucas in a southwesterly direction through the valley of Theochari, and this the modern mule path follows, leading on to Exanthia and Hagios Petros. Above the pass of Spanochori rises Hagios Elias, 568 meters in height. South of Exanthia rises Megan Oros, 1,012 meters high, on the southeastern slope of which is located Enkluvi, 660 meters above the sea. This village has the highest elevation of all in Leucas. Further south are the highest peaks, Epano Pyrgos and Stavrotas, respectively 1,116 meters and 1,141 meters. From this point again the land slopes toward the coast, the Lainaki range, which runs in a southeasterly direction, being the most important one in this part. The ancient city Leucas was situated in the northeastern part, near the place where the isthmus joined Leucas to the mainland. The modern city Leucas, or Hamaxichi, is located on the extreme northeastern point.[81]

Before proceeding to a comparison of the details of Leucas with the description of Homeric Ithaca, we must discuss two passages in the *Odyssey* which certainly make strongly against

[81] Partsch, *Die Insel Leukas.*

the identification proposed by Dr. Dörpfeld, if they do not completely disprove it.

The first narrates how Hermes escorted the souls of the dead suitors to the asphodel meadow. They went by the streams of Oceanus and Leucas rock, by the gates of the sun, and the people of dreams.[82] However visionary this journey may be regarded, the passage shows a knowledge of Leucas rock. In examining the passage we note that the souls of the suitors are represented as being conducted from Ithaca to the asphodel meadow by Leucas rock. Therefore the land of which Leucas rock forms a part was not Ithaca. But this land, in later times at least, is called Leucas. It seems clear, then, that the name Leucas was first applied to the white marble promontory (which is not only the most conspicuous feature of that land, but which, as a dangerous point to sailors, must very early have received a name), and afterwards was extended to the whole peninsula. However this may be, Homer certainly appears to testify against Dr. Dörpfeld's identification of this land with Homeric Ithaca.

The second passage relates to the city Nerikos. When Laertes hears from Odysseus, who has come to his farm, of the struggle with the suitors, he expresses the wish that he might have been at the palace with armor on to assist in warding off the suitors, endowed with the might he had when he captured Nerikos, a well-established city on a peninsula of the mainland, when he was king of the Cephallenians.[83] From this quotation it is evident that Nerikos is not in Ithaca but

[82] *Od.* XXIV. 11 *sqq.*:

πὰρ δ' ἴσαν Ὠκεανοῦ τε ῥοὰς καὶ Λευκάδα πέτρην,
ἠδὲ παρ' ἠελίοιο πύλας καὶ δῆμον ὀνείρων
ἤισαν·

[83] *Od.* XXIV. 376 *sqq.*:

αἲ γάρ, Ζεῦ τε πάτερ καὶ Ἀθηναίη καὶ Ἄπολλον,
οἷος Νήρικον εἷλον, ἐυκτίμενον πτολίεθρον,
ἀκτὴν ἠπείροιο, Κεφαλλήνεσσιν ἀνάσσων,
τοῖος ἐών τοι χθιζὸς ἐν ἡμετέροισι δόμοισιν
τεύχε' ἔχων ὤμοισιν ἐφεστάμεναι καὶ ἀμύνειν
ἄνδρας μνηστῆρας·

on a peninsula of the mainland. Our next information about Nerikos is from Thucydides, in whose time it was a city in Leucas. He says that Asopius, finding that the people of Œniadæ would not attack him, although he had entered the Achelous river with his ships, and his land forces were ravaging their territory, left his land army and, himself sailing away to Leucas, landed at Nerikos.[84] It would be more than strange, on the supposition that this land was originally called Ithaca, if it should have dropped that name and adopted that of Leucas, and had then, by an inexplicable coincidence, given to a city of the newly-named land the name of a city said by Homer to lie outside of Ithaca. Had there been any reason for wishing to obliterate all traces of the fact that Leucas was once Ithaca, the widely renowned home of famous Odysseus, such proceedings might be intelligible; but no such reason could have existed. Every motive would, on the contrary, have impelled the inhabitants to retain the ancient name, and without a definite effort on the part of the inhabitants, aided by the friendly connivance of their neighbors, such a disguise as this theory supposes could not have been effected.

A colony named Leucas was established in the land now known as Leucas by the Corinthians, in the seventh century B. C., under the rule of Cypselus (655–625 B. C.), according to Nicolaus, Strabo, Scymnus, and Antoninus; under the rule of Periander (625–585 B. C.), according to Plutarch, and during the fifth and succeeding centuries, it continued to be called Leucas, as shown by the testimony of Herodotus, Thucydides, Demosthenes, Xenophon, Lycurgus, Polybius, Plutarch, and Pliny.[85] The Corinthians would naturally name

[84] Thuc. III. 7: *ὡς δ' οὐ προσεχώρουν, τὸν μὲν πεζὸν ἀφίησιν, αὐτὸς δὲ πλεύσας ἐς Λευκάδα καὶ ἀπόβασιν ἐς Νήρικον ποιησάμενος ἀναχωρῶν διαφθείρεται.*

[85] Herod. VIII. 45: *Λευκάδιοι—ἔθνος ἐόντες οὗτοι Δωρικὸν ἀπὸ Κορίνθου.*

Thuc. I. 30, 2: *τῆς θαλάσσης ἀπάσης ἐκράτουν τῆς κατ' ἐκεῖνα τὰ χωρία οἱ Κερκυραῖοι, καὶ πλεύσαντες ἐς Λευκάδα τὴν Κορινθίων ἀποικίαν τῆς γῆς ἔτεμον —. Cf.* Thuc. I. 46; II. 80, 3; III. 95, 1; III. 102, 3; VI. 104, 1; VII. 2, 1; VII. 7, 1; VII. 58, 3; VIII. 13.

Dem. *Phil.* III. 34: *οὐ Κορινθίων ἐπ' Ἀμβρακίαν ἐλήλυθε καὶ Λευκάδα;*

Xen. *Hell.* VI. 2, 26: *καὶ ἐκεῖνοι μὲν εἰς Λευκάδα ἀπεσώθησαν.*

the newly established colony after the land itself. The presumption, then, from this evidence is that the land was called Leucas before the colonization by the Corinthians, and it certainly was so called afterwards, as the testimony adduced shows. The evidence, then, leads to the conclusion that it bore the name Leucas from the earliest times down to the present. The burden, therefore, rests on the advocates of the theory to show that Leucas was ever called Ithaca. Only the most complete identity in physical features and relative position can suffice to overcome this evidence. Let us see whether such identity exists.

Examining the Homeric description, we noted first that Ithaca is an island, is sea-girt, and is surrounded by other islands. We shall consider whether Leucas fulfils these conditions. Two authors, at least, of antiquity, in addition to a scholiast, considered it as a peninsula in the Homeric period. A scholion[86] to *Od.* XXIV. 376, where it is stated that Nerikos is on a peninsula of the mainland, identifies Νήρικος with Leucas of his own time, and Strabo, speaking of Leucas, says that in ancient times it was a peninsula of the land of the Acarnanians, and that the poet (Homer) calls it a peninsula of the mainland.[87] Stephanus of Byzantium states that the peninsula on which Nerikos was situated was a part of Acarnania.[88] Further, the evidence from the classical period, as

Lycurg. *Or. c. Leocr.* 26: *ἐκ τῆς Ἠπείρου παρὰ Κλεοπάτρας εἰς Λευκάδα ἐσιτήγει καὶ ἐκεῖθεν εἰς Κόρινθον.*

Polybius V. 16: *ὁ δὲ βασιλεὺς ἀναχθεὶς παντὶ τῷ στόλῳ καὶ διάρας τὸν κόλπον ὡς θᾶττον εἰς τὴν Λευκάδα καθωρμίσθη.* *Cf.* Polyb. V. 17; V. 18.

Plut. *Tim.* 15: *Λευκάδα—πόλιν ἀπῳκισμένην ὑπὸ Κορινθίων ὥσπερ τὴν Συρακουσίων.* *Cf.* Plut. *Them.* 24.

Pliny, *N. H.*, IV. 12 (19). Inter Leucadiam autem et Achaiam permultae, quarum Teleboides eaedemque Taphiae, ab incolis appellantur Taphias, Carnos, Oxia, Prinoessa.

[86] Νήρικον] *τὴν νῦν Λευκάδα καλουμένην.*

[87] Strabo, X. 2, 8: *αὕτη δὲ (ἡ Λευκάς) ἦν τὸ παλαιὸν μὲν χερρόνησος τῆς Ἀκαρνάνων γῆς· καλεῖ δ' ὁ ποιητὴς αὐτὴν ἀκτὴν ἠπείροιο, τὴν περαίαν τῆς Ἰθάκης καὶ τῆς Κεφαλληνίας ἤπειρον καλῶν. αὕτη δ' ἐστὶν ἡ Ἀκαρνανία· ὥστε, ὅταν φῇ ἀκτὴν ἠπείροιο, τῆς Ἀκαρνανίας ἀκτὴν δέχεσθαι δεῖ.*

[88] Steph. Byz., *s. v.* "Νήρικος": *Νήρικος πόλις Ἀκαρνανίας, ἣν Ὅμηρος Ἀκτὴν φησιν ἠπείροιο, ἥτις ἐστὶν Ἀκαρνανία.*

well as that from later times, shows that Leucas was then a peninsula, and the isthmus is often mentioned. The Peloponnesians returning home from Corcyra carry their ships over the *isthmus of the Leucadians*, so as not to be seen sailing around Leucas, according to Thucydides.[89] The ships of the Peloponnesians are said again to have been brought over the *isthmus of the Leucadians*. After the Peloponnesians withdrew from Attica, the Spartans went to the assistance of Pylus, and, besides passing the word about the Peloponnesus to render aid as quickly as possible, sent for the sixty ships of theirs that were at Corcyra. These being brought over the isthmus of the Leucadians arrived at Pylus undetected by the Athenian ships at Zacynthus.[90] Again the same author[91] states that the Leucadians, although the borders of their land were being ravaged, and that part within *the isthmus*, kept quiet because they were pressed by a large force. Scylax[92] also refers to Leucas as a peninsula, and describes it in such a way as to prove that it is the same as the modern Leucas or Santa Maura. He mentions peninsula, city, and harbor Leucas, and says the peninsula terminates in a promontory extending into the sea. Further, the isthmus of the Leucadians is referred to in a passage from the commentary of C. Julius Hyginus on the *Propempticon* of Asinius Pollio, quoted by Flavius Sosipater Charisius. It narrates: "Sailing from Actium sixty stadia, they arrive at the isthmus of the Leucadians. There it is customary, in order to shorten the voyage, to drag the ship across with a towing-cable which in Greek is called *πάκτων*."[93]

[89] Thuc. III. 81, 1: *οἱ μὲν οὖν Πελοποννήσιοι τῆς νυκτὸς εὐθὺς κατὰ τάχος ἐκομίζοντο ἐπ' οἴκου παρὰ τὴν γῆν, καὶ ὑπερενεγκόντες τὸν Λευκαδίων ἰσθμὸν τὰς ναῦς, ὅπως μὴ περιπλέοντες ὀφθῶσιν, ἀποκομίζονται.*

[90] Thuc. IV. 8, 2: *αἱ ὑπερενεχθεῖσαι τὸν Λευκαδίων ἰσθμὸν καὶ λαθοῦσαι τὰς ἐν Ζακύνθῳ Ἀττικὰς ναῦς ἀφικνοῦνται ἐπὶ Πύλον.*

[91] Thuc. III. 94, 2: *καὶ οἱ μὲν Λευκάδιοι τῆς τε ἔξω γῆς δῃουμένης καὶ τῆς ἐντὸς τοῦ ἰσθμοῦ, ἐν ᾗ καὶ ἡ Λευκάς ἐστι καὶ τὸ ἱερὸν τοῦ Ἀπόλλωνος πλήθει βιαζόμενοι ἡσύχαζον.*

[92] Scylax, *Periplus* 34: *ἀκτὴ καὶ πόλις Λευκὰς καὶ λιμήν· αὕτη ἀνέχει ἐπὶ τὸν Λευκάταν, ὅ ἐστιν ἀκροτήριον πόρρωθεν ἐν τῇ θαλάσσῃ.*

[93] *Grammatici Latini*, ed. Keil, I. p. 134: Ab Actio navigantes stadia LX veniunt ad Isthmum Leucadiensium; ibi solent iteris minuendi causa remulco, quem Graece *πάκτωνα* dicunt, navem traducere.

Again, Ovid[94] in his *Metamorphoses* says that when the ancient colonists held Leucas it was joined to the mainland, but in his time it was separated from it by a strait. Plutarch also refers to Leucas as the peninsula of the Leucadians.[95]

The evidence presented, therefore, shows that even after Leucas was artificially made an island by the Corinthians who dug a canal through the isthmus, it was regarded as a peninsula by the people; and previous to the cutting of the canal it must have been a peninsula. Furthermore, even at the present time it is really a peninsula. Leucas, therefore, was not originally an island and later a peninsula, as Dörpfeld's theory assumes; on the contrary, the further back we go in its history the less of an island we find it to be. This is clearly shown by geological evidence presented by Neumann and Partsch, who assert in their *Physikalische Geographie von Griechenland* that in the Tertiary period Leucas, Cephallenia, and Zacynthus formed the outer boundary of a fresh-water lake in Ætolia, Acarnania and Achæa, shutting it off from the sea. Leucas, therefore, was originally connected with the mainland. On page 266 of their work they say:

> In Aetolien, Akarnanien, und Achaia liegen Ablagerungen eines tertiären Süsswassersees vor, welcher vom nahen Hauptbecken des Mittelmeeres durch einen Festlandsdamm geschieden gewesen sein muss, dessen Trümmer die Inseln Zante, Kephalonia, und Santa Maura zu sein scheinen; auf der erstgenannten Insel ist das tertiäre Seeufer noch deutlich erkennbar.

Further, on page 130 of the same work they explain how

[94] Ovid, *Metamorph.*, XV. 289 *sqq.*:

> Leucada continuam veteres habuere coloni:
> Nunc freta circumeunt. Zancle quoque juncta fuisse
> Dicitur Italiae, donec confinia pontus
> Abstulit et media tellurem reppulit unda.

[95] Plut., *De sera numinis vindicta* 7 p. 552 E: *Σκόπει γάρ, εἰ Διονύσιος ἐν ἀρχῇ τῆς τυραννίδος ἔδωκε δίκην, ὡς οὐδεὶς ἂν Ἑλλήνων ᾤκει Σικελίαν ἀνάστατον ὑπὸ Καρχηδονίων γενομένην, ὥσπερ οὐδ' Ἀπολλωνίαν, οὐδ' Ἀνακτόριον οὐδὲ τὴν Λευκαδίων χερρόνησον ᾤκουν Ἕλληνες, εἰ Περίανδρος ἐκολάσθη μὴ μετὰ πολὺν χρόνον.*

It is to be inferred that Leucas was once a peninsula, from Pliny, *N. H.*, 90 205): Perrupit mare Leucada, Antirrhium, Hellespontum, Bosporos duos.

Leucas came into the condition in which it was found in classical antiquity. They say:

Je weiter wir nach Süden schreiten, desto tiefer dringt das Meer in das Land ein. Im Westen hat es das felsige Leukas vom akarnanischen Festlande so weit getrennt, dass beide nur durch einen ganz schmalen und flachen Isthmus zusammenhängen, den die Corinther, als sie diesen Landstrich in Besitz nahmen, durchgraben konnten; und je nachdem dieser Kanal in späterer Zeit versandet oder wieder gereinigt war, wurde Leukas als Halbinsel oder Insel bezeichnet.

The canal was cut by the Corinthians under the rule of Kypselus, as we learn from Strabo,[96] and doubtless at the time when the land was colonized by them. The same author in another passage[97] refers to the cutting of the canal by the Corinthians. Other writers also mention the making of the canal. Scylax[98] says that Leucas was in his time (IV. cent. B. C.) an island, made so by the cutting of a canal through the isthmus. Livy also, speaking of the siege of Leucas in 197 B.C., says that in his time it was an island by reason of a shallow canal, artificially made, that divided it from Acarnania.[99] Pliny,[100] too, mentions the fact that Leucas was formerly a peninsula and was cut away from the mainland, being joined again to it by accumulation of sand.

By the evidence so far presented we have shown in the

[96] Strabo X. 2, 8: Κορίνθιοι δὲ πεμφθέντες ὑπὸ Κυψέλου καὶ Γόργου ταύτην τε κατέσχον τὴν ἀκτὴν καὶ μέχρι τοῦ Ἀμβρακικοῦ κόλπου προῆλθον, καὶ ἡ τε Ἀμβρακία συνῳκίσθη καὶ Ἀνακτόριον, καὶ τῆς χερρονήσου διορύξαντες τὸν ἰσθμὸν ἐποίησαν νῆσον τὴν Λευκάδα.

[97] Strabo I. 3, 18: τόν τε Πειραιᾶ νησιάζοντα πρότερον καὶ πέραν τῆς ἀκτῆς κείμενον οὕτως φασὶν ὀνομασθῆναι· ὑπεναντίως δ' ἡ Λευκὰς Κορινθίων τὸν ἰσθμὸν διακοψάντων νῆσος γέγονεν, ἀκτὴ πρότερον οὖσα·

[98] Scylax, *Periplus* 35: Αὕτη δ' ἐστὶ νῦν νῆσος τὸν ἰσθμὸν ἀποτεταφρευμένη· Μετὰ δὲ ταῦτα πόλις Φαρά· καὶ κατὰ ταῦτα νῆσός ἐστιν Ἰθάκη καὶ πόλις καὶ λιμήν.

It is to be observed that this passage fixes the location of Leucas.

[99] Livy XXXIII. 17: Leucadia nunc insula est, vadoso freto, quod perfossum manu est, ab Acarnania divisa; tum paeninsula erat, occidentis regione artis faucibus cohaerens Acarnaniae.

[100] Pliny, *N. H.* IV. 2: Egressos sinu Ambracio in Ionium excipit Leucadium litus, promontorium Leucates, dein sinus et Leucadia ipsa paeninsula quondam Neretis appellata, opere accolarum abscissa continenti ac reddita ventorum flatu congeriem harenae adtumulantium.

first place that, in all probability, Leucas was so called in the Homeric period, that it was known under that name in the seventh century B. C., and that it bore that name during the successive centuries down to the Christian era, and still retains it; in the second place, that it was a peninsula in the Homeric period, that it was cut apart from the mainland in the seventh century B. C. by a canal, but continued to be called a peninsula and to be so regarded by writers down to the Christian era; further, that it was not originally an island, for from geological evidence Leucas originally formed part of a land barrier between the ocean and a fresh-water lake in the territory now known as Acarnania, Ætolia, and Achæa. If now we remember Ithaca as an island, contrasted as such with the mainland,[101] referred to as a place from which one naturally departs by ship, definitely called an island by Telemachus,[102] and regularly characterized as sea-girt, it becomes clear that Leucas can not be the Homeric Ithaca, even if we had no other evidence. But such evidence is not wanting, for in many other respects Leucas fails to fulfil the conditions of Homeric Ithaca as enumerated in the earlier part of this paper. In the first place, it is not visible from the west coast of Elis.[103] In the second place, it is more than a night's journey[104] from Pylus.[105] In the third place, from Leucas Odysseus would hardly be supposed to flee to Elis and to Pylus[106] to escape the suitors, but to the immediately adjacent shore of Acarnania.

Moreover, it is not a low[107] island, even in comparison with the other islands in this region, as it contains four mountains whose elevation exceeds 1,000 meters; it is not surrounded

[101] *Od.* XIV. 97; XVIII. 83 *sqq.*

[102] *Od.* IV. 607 *sqq.*

[103] See p. 5.

[104] See p. 7.

[105] Victor Bérard, in his article, "La Pylos Homérique," published in the *Revue Archéologique*, 1900, advances the theory that Homeric Pylus was not the Pylus of classical times, located in Messenia, but was situated on the coast of Elis, a short distance south of the mouth of the Alpheus river. If his theory is true, it does not affect the argument of this paper, but there are grave objections to his theory.

[106] See p. 8.

[107] See n. 27, p. 9.

by many islands[107] close to each other, and it does not lie furthest west in the sea.[107] There are no islands west of it at all, and it is the northernmost one of the group to which it belongs.

The passage in the *Odyssey*[107] where Homeric Ithaca is described seems clear enough when interpreted naturally and without reference to any preconceived ideas. Discussion has, however, arisen in regard to the real meaning of two words, χθαμαλή and ζόφος. These mean respectively "low" and "the west." The former occurs several times in the Homeric poems, so that we have some means of ascertaining its signification. In speaking of Circe's isle the poet uses the same expression, "αὐτὴ δὲ χθαμαλὴ κεῖται,"[108] "it lies low." Völker (*Homerische Geographie*, p. 54) objects to this rendering of the word in the passage quoted on the ground that it is inconsistent with certain other passages in the tenth book, in which it is stated that Odysseus climbed to a "rugged outlook,"[109] "walked up the solemn glades"[110] on his way to Circe's house, and was asked by Hermes where he was going "along the hills[111] alone, ignorant of the land." Surely one cannot insist that when a poet calls an island low, it must be perfectly flat and have no elevations such as are described

[108] *Od.* X. 194 *sqq.*:

εἶδον γὰρ σκοπιὴν ἐς παιπαλόεσσαν ἀνελθὼν
νῆσον, τὴν πέρι πόντος ἀπείριτος ἐστεφάνωται
αὐτὴ δὲ χθαμαλὴ κεῖται· καπνὸν δ' ἐνὶ μέσσῃ
ἔδρακον ὀφθαλμοῖσι διὰ δρυμὰ πυκνὰ καὶ ὕλην.

[109] *Od.* X. 148 *sqq.*:

ἵστην δὲ σκοπιὴν ἐς παιπαλόεσσαν ἀνελθών,
καί μοι ἐείσατο καπνὸς ἀπὸ χθονὸς εὐρυοδείης,
Κίρκης ἐν μεγάροισι, διὰ δρυμὰ πυκνὰ καὶ ὕλην.

[110] *Od.* X. 275 *sqq.*:

ἀλλ' ὅτε δὴ ἄρ' ἔμελλον ἰὼν ἱερὰς ἀνὰ βήσσας
Κίρκης ἵξεσθαι πολυφαρμάκου ἐς μέγα δῶμα,
ἔνθα μοι Ἑρμείας χρυσόῤῥαπις ἀντεβόλησεν.

[111] *Od.* X. 281 *sq.*:

πῇ δὴ αὖτ', ὦ δύστηνε, δι' ἄκριας ἔρχεαι οἶος,
χώρου ἄιδρις ἐών;

as *σκοπιὴ παιπαλόεσσα*, *ἱεραὶ βῆσσαι*, and *ἄκριαι*, especially as the islands of Greece are almost all mountainous and thus high. In the description of Laertes's life on his farm we are informed that, when summer and fall come, *low* beds of fallen leaves are spread for him all about his vineyard.[112] The same word is used in this sense in the comparative degree in the passage relating to Scylla and Charybdis. Circe describes to Odysseus the two crags, "one reaching up to the broad heavens with its sharp peak," half way up, a cave in which Scylla lives; the second crag is *lower*, and is close beside the first.[113] In the *Iliad* also we have the word used in the same sense, here in the superlative degree, applied to the wall around the Greek camp. Hector keeps fighting where the ships of Aias and Protesilaus are drawn up on the beach of the hoary sea, while above the wall had been built *lowest*, and there especially the heroes and their horses were raging in battle.[114] The scholion[115] to the passage offers an explanation of the wall's being low, which shows that the scholiast understood the word in that sense. This was also the understanding of the scholiast upon *Od.* IX. 25,[116] who attempts

[112] *Od.* XI. 192 *sqq.*:

αὐτὰρ ἐπὴν ἔλθῃσι θέρος τεθαλυῖά τ' ὀπώρη,
πάντῃ οἱ κατὰ γουνὸν ἁλωῇ οἰνοπέδοιο
φύλλων κεκλιμένων χθαμαλαὶ βεβλήαται εὐναί.

[113] *Od.* XII. 101 *sq.*:

τὸν δ' ἕτερον σκόπελον χθαμαλώτερον ὄψει, Ὀδυσσεῦ,
πλησίον ἀλλήλων.

[114] *Il.* XIII. 681 *sqq.*:

ἔνθ' ἔσαν Αἴαντός τε νέες καὶ Πρωτεσιλάου
δῖν' ἐφ' ἁλὸς πολιῆς εἰρυμέναι, αὐτὰρ ὑπερθεν
τεῖχος ἐδέδμητο χθαμαλώτατον, ἔνθα μάλιστα
ζαχρηεῖς γίγνοντο μάχῃ αὐτοί τε καὶ ἵπποι.

[115] Schol. *Il.* XIII. 683: *τεῖχος χθαμαλώτατον ἀντὶ τοῦ χθαμαλόν, ὡς "ἀκρότατον δ' ἄρ' ὄϊστός" (Il.* IV. 139)· *ἦν δὲ χθαμαλὸν διὰ τὸ ἀφῃρῆσθαι τῆς ἐπάλξεως ὑπὸ Σαρπηδόνος, ἢ ὡς πρὸς σύγκρισιν τοῦ πολυανδρίου, ὡς ἠπειγμένως ποιήσαντες οὐκ ἐξωμάλισαν αὐτό; διὸ καὶ ἡ ὑπέρβασις τοῖς βαρβάροις δυνατὴ γέγονεν.*

[116] Schol. *Od.* IX. 25: *πῶς χθαμαλή; πῶς πανυπερτάτη; ἡ δὲ σύγκρισις ἡ πρὸς τὰς ἄλλας νήσους ποιεῖ αὐτὴν λέγεσθαι χθαμαλήν, αὐτὴ δὲ κατ' αὐτὴν μὴ ἀντεξεταζομένη πρὸς Σάμον καὶ Ζάκυνθον ὑψηλή ἐστιν. ἐπὶ δὲ τὸ πρὸς δύσιν αὐτῆς μέρος ὑψηλή ἐστι διὰ τὸ ὄρος, τὸ δὲ πρὸς ἀνατολὴν χθαμαλή. εἰκὰς οὖν ἔχειν αὐτὴν ἄμφω. ἡ χθαμαλὴ μὲν διὰ τὴν θέσιν, πανυπερτάτη δὲ διὰ τὴν τῶν οἰκούντων λαμπρότητα·*

to remove the apparent contradiction between the adjective *χθαμαλή* and the presence of the wooded mountain Neriton by suggesting that Ithaca is low in comparison with the other islands. Strabo,[127] commenting on the same passage, renders *χθαμαλή* by *ταπεινὴ καὶ χαμηλή*, in contrast to *παντοπερτάτη*, which he explains as *ὑψηλή*.

According to Dr. Dörpfeld, Leucas does fulfil the condition imposed by *χθαμαλή*, since it lies "near the shore." In his view that is the meaning of the word. But no evidence is presented to show that it legitimately has such meaning; and, furthermore, such a rendering is entirely inapplicable to the beds of leaves in Laertes's orchard,[128] as well as to Circe's isle, which is said to be surrounded by the boundless sea.[129]

The other word, *ζόφος*, occurs often enough in the Homeric poems to enable us to determine its meaning. It means the darkness of Hades's abode, or the abode itself, as in *Od.* XI. 57, where Odysseus in the under world asks Elpenor how he came there: "*Ἐλπῆνορ, πῶς ἦλθες ὑπὸ ζόφον ἠερόεντα;*" Many other passages show the same meaning.[130] Then it means the west, as the place of darkness, where the light goes under the darkness; where the sun sets and darkness comes on.[131] Its

[127] Strabo X. 2, 12: *καὶ τοῦτο δὲ δοκεῖ ὑπεναντιότητά τινα δηλοῦν "αὐτὴ δὲ χθαμαλὴ παντοπερτάτη εἰν ἁλί κεῖται." χθαμαλὴ μὲν γὰρ ἡ ταπεινὴ καὶ χαμηλή, παντοπερτάτη δὲ ἡ ὑψηλή, οἷον διὰ πλειόνων σημαίνει.*

Cf. Aratus, *Phaenomena* 991 *sqq.*:

αἵ γε μὲν ἠερόεσσα παρὲξ ὄρεσι μεγάλοιο
τυθμένα τείνηται νεφέλη ἄκραι δὲ κολῶναι
φαίνονται καθαραί, μάλα κεν τόθ' ὑπεύδιος αἴης.
εὔδιός κ' αἴης, καὶ ὅτε πλατέοι παρὰ πόντου
φαίνηται χθαμαλὴ νεφέλη μηδ' ὑψόθι κόρης
ἀλλ' αὐτοῦ πλαταμῶνι παραθλίβηται ὁμοίη.

and Orpheus, *Argonautica* 1141 *sq.*:

ἀμφὶ δέ οἱ χθαμαλή τε καὶ εὔβοτος Ἑρμίονεια
τείχεσιν ἠρήρεισται ἐυκτιμέναις ἐπ' ἀγυιαῖς.

[128] *Od.* XI. 194. [129] *Od.* X. 195. See notes 108 and 112.

[130] *Od.* XI. 155; *Od.* XX. 356; *Il.* XV. 191; *Il.* XXI. 56; *Il.* XXIII. 51; *Hym. Cer.* 80. 337, 402.

[131] *Od.* III. 335 *sq.*:

ἤδη γὰρ φάος οἴχετ' ὑπὸ ζόφον, οὐδὲ ἔοικεν
δηθὰ θεῶν ἐν δαιτὶ θαασσέμεν, ἀλλὰ νέεσθαι.

Od. III. 329: *ὣς ἔφατ', ἠέλιος δ' ἄρ' ἔδυ καὶ ἐπὶ κνέφας ἦλθεν.*

use in the sense of "west" is made clear by passages in which it is contrasted with ἠώς and ἠέλιος which, of course, refer to the east, where the dawn and sun appear.[122] A good example of this is furnished by *Il.* XII. 238 *sqq.*,[123] where Hector says to Polydamas that he pays no attention to the flight of birds, whether they go to the right toward the dawn and sun (east), or to the left toward the shadowy darkness (west). In *Od.* XIII. 241 *sqq.*,[124] the contrast is emphasized by the addition of the word μετόπισθε. When Odysseus inquires of Athena on what shore he has landed, she replies: "You are simple or have come from afar, if you are ignorant of this land. Many know it very well, both those that dwell toward the dawn and the sun (east), and those that dwell in the *opposite direction* toward shadowy darkness (west)." In *Od.* X. 190 *sqq.*,[125] ζόφος and ἠώς are absolutely defined as the places where the sun sets and where it rises. Odysseus says to his men on Circe's isle, "We do not know where the west (ζόφος) is, nor where the east (ἠώς); that is, neither where the shining sun goes under the earth, nor where it rises." Since ζόφος means "west," Ithaca, accord-

[122] That ἠώς means "east" is shown by the use of the adjective ἠῷος (eastern) in contrast to ἑσπέριος (western). Alcinous in announcing Odysseus's arrival says: "I do not know who this stranger is. He came to my house wandering either from eastern or western men."

Od. VIII. 29 *sq.*: ξεῖνος δδ', οὐκ οἶδ' ὅς τις, ἀλώμενος ἵκετ' ἐμὸν δῶ,
ἠὲ πρὸς ἠείων ἢ ἑσπερίων ἀνθρώπων.

In the explanation of *Od.* IX. 22 *sqq.* it is asserted by some that the use of ἠέλιος refers to the south. This does not seem to be justified. When ἠέλιος indicates direction it means "east," not "south." It is, however, used to indicate time of day, as in the expression "when the sun reached midheaven," that is, "at noon" (ἦμος δ' ἠέλιος μέσον οὐρανὸν ἀμφιβεβήκῃ). *Cf. Il.* VIII. 68 *sqq.*; *Il.* XVI. 778 *sqq.*; *Od.* IV. 400 *sqq.*

[123] τῶν οὔ τι μετατρέπομ' οὐδ' ἀλεγίζω,
εἴ τ' ἐπὶ δεξί' ἴωσι πρὸς ἠῶ τ' ἠέλιόν τε,
εἴ τ' ἐπ' ἀριστερὰ τοί γε ποτὶ ζόφον ἠερόεντα.

[124] ἴσασι δέ μιν μάλα πολλοί,
ἡμὲν ὅσοι ναίουσι πρὸς ἠῶ τ' ἠέλιόν τε
ἠδ' ὅσσοι μετόπισθε ποτὶ ζόφον ἠερόεντα.

[125] ὦ φίλοι, οὐ γάρ τ' ἴδμεν ὅπῃ ζόφος οὐδ' ὅπῃ ἠώς,
οὐδ' ὅπῃ ἠέλιος φαεσίμβροτος εἰσ' ὑπὸ γαῖαν,
οὐδ' ὅπῃ ἀνιεῖται·

ing to *Od.* IX. 26, must lie furthest toward the west in the sea. This condition Leucas certainly does not fulfil. Dr. Dörpfeld, however, while accepting the meaning "west" for ζόφος, holds that Leucas does fulfil the condition in that it is the last land to be passed by ships bound west as they go north along the shore to a point where the sea is narrower and therefore safer for passsage. Strabo[126] mentions the fact that some interpret ζόφος as meaning "north," and asserts that Ithaca does not lie low and furthest to the west, but near the mainland and toward the north.

Further, in contrast to Homeric Ithaca, which has not good meadows nor wide driving courses,[127] Leucas has good meadows and is suitable for driving horses. In the northeastern part there is a fertile, well-watered plain four kilometers long by from one to two and a half wide.[128]

Furthermore, if Leucas be taken for Ithaca, it is difficult to explain the attempt of the suitors to intercept Telemachus on his return from Pylus by lying in wait for him on the little island Asteris. It lies in the midst of the strait between Ithaca and Samos, and is described as small, rocky, with windy heights, and safe double harbors.[129] Across this strait a ferry plies between Ithaca and Samos.[130] When the suitors learn that Telemachus has gone to Pylus, they plan to intercept him on his return. Antinous asks for a swift ship and twenty companions to lie in wait for him in the strait between Ithaca and Samos.[131] When Athena at Menelaus's palace urges

[126] Strabo X. 2, 12, c. 454 and 455: *οὔτε γὰρ χθαμαλὴν δέχονται ταπεινὴν ἐνταῦθα, ἀλλὰ πρόσχωρον τῇ ἠπείρῳ ἐγγυτάτω οὖσαν αὐτῆς· οὔτε πανυπερτάτην ὑψηλοτάτην ἀλλὰ πανυπερτάτην πρὸς ζόφον, οἷον ὑπὲρ πάσας ἐσχάτην τετραμμένην πρὸς ἄρκτον· τοῦτο γὰρ βούλεται λέγειν τὸ πρὸς ζόφον, τὸ δ' ἐναντίον πρὸς νότον "αἱ δέ τ' ἄνευθε πρὸς ἠῶ τ' ἠέλιόν τε." τὸ γὰρ ἄνευθε πόρρω καὶ χωρὶς ἔστιν, ὡς τῶν μὲν ἄλλων πρὸς νότον κεκλιμένων καὶ ἀπωτέρω τῆς ἠπείρου, τῆς δ' Ἰθάκης ἐγγύθεν καὶ πρὸς ἄρκτον.*

[127] See p. 12.

[128] Partsch, J., *Die Insel Leukas* p. 11.

[129] See pp. 19 *sqq.*

[130] See pp. 6 and 7.

[131] *Od.* IV. 669 *sqq.*:

ἀλλ' ἄγε μοι δότε νῆα θοὴν καὶ εἴκοσ' ἑταίρους,
ὄφρα μιν αὐτὸν ἰόντα λοχήσομαι ἠδὲ φυλάξω
ἐν πορθμῷ Ἰθάκης τε Σάμοιό τε παιπαλοέσσης.

Telemachus to return home, she warns him that suitors lie in wait for him in the strait between Ithaca and Samos, desiring to kill him before he reaches his native land.[132] As to the method of keeping watch Antinous says, "By day our sentries sat upon the windy heights, posted in close succession; and after sunset we did not pass the night ashore, but sailed our swift ship on the sea awaiting sacred dawn, lying in wait to seize and slay Telemachus."[133]

It is clear that the strait between Ithaca and Samos must be narrow. In the first place, a ferry plies across it. In the second place, the suitors are very anxious to intercept Telemachus because they want to kill him. They would, therefore, select a place to lie in wait for him so narrow that they would be sure to observe him, at any rate, if he returned by day. That they do this is shown by the fact that they select an island in a strait and are content by day to sit upon its windy heights and watch.

Dr. Dörpfeld identifies modern Ithaca with Samos, the water between it and Leucas with the strait referred to by Homer, and Arkoudi, an island southeast of Leucas, with Asteris. But these places do not satisfy the conditions, for the distance from the northernmost point of Ithaca to the southernmost point of Leucas is eighteen miles, and Vlicho bay, on which Dr. Dörpfeld locates the Homeric city Ithaca, is near the middle of the eastern coast of Leucas. A boat, therefore, plying between Vlicho bay and any point of modern Ithaca would hardly be called a ferry. Further, the stretch

[132] *Od.* XV. 28 *sqq.*:

μνηστήρων σ' ἐπιτηδὲς ἀριστῆες λοχόωσιν
ἐν πορθμῷ Ἰθάκης τε Σάμοιό τε παιπαλοέσσης,
ἱέμενοι κτεῖναι πρὶν πατρίδα γαῖαν ἱκέσθαι.

[133] *Od.* XVI. 365 *sqq.*:

ἤματα μὲν σκοποὶ ἷζον ἐπ' ἄκριας ἠνεμοέσσας
αἰὲν ἐπασσύτεροι· ἅμα δ' ἠελίῳ καταδύντι
οὔ ποτ' ἐπ' ἠπείρου νύκτ' ἄσαμεν, ἀλλ' ἐνὶ πόντῳ
νηὶ θοῇ πλείοντες ἐμίμνομεν Ἠῶ δῖαν
Τηλέμαχον λοχόωντες, ἵνα φθίσωμεν ἑλόντες
αὐτόν·

of water between the two is more like open sea than a strait; and, in any case, it certainly is not as narrow a strait as is required by the Homeric account. Manifestly it would be utterly futile for the suitors from a position on the island Arkoudi to attempt to control such a wide expanse of water so as to intercept Telemachus on his way from Pylus to Vlicho bay.

But Dr. Dörpfeld thinks he has a strong support for his identification of Asteris in the fact that Arkoudi has a double harbor. An examination of the coast line, under the guidance of Dr. Dörpfeld, showed, however, no such harbor. The eastern shore of the island, where the double harbor is said to lie, is practically a straight line from which a rocky strip, a few yards wide and four to six feet high, extends at right angles to the shore to a distance of about seventy-five yards. The surface of this rocky strip shows, as may be seen from the accompanying cut, that the water dashes over it readily, so that the whole shore is entirely unprotected and can not be said to have any harbor at all.

It must be admitted, however, that Leucas does fulfil some of the conditions of Homeric Ithaca. The same thing may, indeed, be said of almost any Greek island. There are islands between Leucas and Elis; Leucas contains mountains that may be taken for Neion and Neriton, though none are known to have borne these names at any time; it is on the way from Thesprotia to Dulichium, whichever of the three suggested locations is assigned to the latter; it is "rough," "rocky," "far-seen," will "support goats and cattle," "produces wine," "has perennial springs," and has harbors which may be taken for the harbors of Homeric Ithaca. Vasiliki is thought by Dr. Dörpfeld to be the bay in which Telemachus landed on his return from Pylus, Sybota bay is identified with Phorcys harbor, and Reithron is placed on the eastern shore of Leucas. But no amount of agreement in such details could counterbalance the striking discrepancies in the really significant features discussed above; and, furthermore, modern Ithaca not only has a closer agree-

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ment than Leucas with the Homeric description in these minor details, but, as will be shown below, fulfils the conditions in the essential features in which Leucas fails utterly. Leucas, then, is out of the question and we may pass to a discussion of modern Ithaca.

CHAPTER III

Modern Ithaca

The modern island of Ithaca has an area of thirty-seven and a half square miles, and is seventeen miles from north to south and four miles from east to west at its widest part. It is deeply indented on the eastern side by the gulf of Molo, the northern and southern parts of the island being connected by an isthmus of from 600 to 800 yards wide. The shore on the south side of the gulf of Molo is indented by three bays, Dexia, Vathy, and Skhinos. In the northern half of the island the harbor of Polis is on the west side, that of Aphales on the north, and on the east are the bays of Phrikes and Kioni. South of the isthmus is a small bay called Opiso Æto. At the southern end of the southern half is the bay of Andri; on the eastern side is the bay of Ligia. A chain of mountains runs from north to south. In the northern half this rises to a height of 807 meters in the peak Anoi or Anogi. In the southern, the highest peak is Hagios Stephanos or Merovigli, 671 meters high. Ætos on the isthmus is 375 meters high. At the north end of the island is a rivulet fed by several springs. The largest city is Vathy, on the bay of the same name, with a population of 5,000. The total population of the island is about 13,000. It is about eighteen miles south of Leucas, twenty-five or thirty miles west of the coast of Acarnania, and is separated from the northern part of Cephallenia by a strait about two miles wide.

This island bore the name of Ithaca as early as the fourth century B. C., as is shown by testimony of authors of that time, and still bears that name as well as that of Thiaki, a modern Greek corruption of the same word. In the complete absence of evidence to the contrary, it is fair to infer that the island always had this name and consequently that it is the Ithaca of Homer. The position of the island known as Ithaca

in the fourth and succeeding centuries is clearly shown by references to it in the writings of contemporary authors. According to Scylax[134] it lies south of Leucas and on the way from Leucas to Cephallenia.

In Virgil, *Aen.* III. 270 *sqq.*, it is referred to as being between Zacynthus on the south and Leucas on the north.[135] Strabo (II. 5, 20) also definitely locates it with reference to the Corinthian gulf, Cephallenia, and Zacynthus. He says: "There are islands there, Corcyra and Sybota before the mainland; and next in front of the Corinthian gulf Cephallenia, Ithaca, Zacynthus, and the Echinades."[136] The same general position is indicated by Strabo (VIII. 2, 2),[137] where he says that Eleia is turned toward the north and the beginning of the Corinthian gulf as far as the headland Araxus, opposite which, across the strait, are Acarnania and the adjacent islands Zacynthus, Cephallenia, Ithaca, and the Echinades, of which Dulichium is one. Stephanus Byzantius[138] states that Ithaca is an island near Cephallenia. Porphyry places it twelve stadia east of Cephallenia.[139]

Modern Ithaca satisfies most of the conditions of Homeric Ithaca. First of all, it is an island,[140] and is situated where

[134] Scylax, *Periplus* 35: *αὕτη δ' (Λευκάς) ἐστὶ νῦν νῆσος τὸν ἰσθμὸν ἀποτεταφρευμένη. Μετὰ δὲ ταῦτα πόλις Φαρά· καὶ κατὰ ταῦτα νῆσός ἐστιν Ἰθάκη καὶ πόλις καὶ λιμήν. Μετὰ ταῦτα νῆσος Κεφαλληνία.*

[135] Iam medio apparet fluctu nemorosa Zacynthus
Dulichiumque Sameque et Neritos ardua saxis
Effugimus scopulos Ithacae, Laertia regna
Et terram altricem saevi execramur Ulyssis
Mox et Leucatae nimbosa cacumina montis.

[136] *νῆσοι δ' εἰσὶν ἐνταῦθα ἥ τε Κόρκυρα καὶ Σύβοτα πρὸ τῆς Ἠπειρώτιδος, καὶ ἐφεξῆς πρὸ τοῦ Κορινθιακοῦ κόλπου Κεφαλληνία καὶ Ἰθάκη καὶ Ζάκυνθος καὶ Ἐχινάδες.*

[137] *ἡ μὲν Ἠλεία πρὸς ἄρκτον ἐπιστρέφουσα καὶ τὴν ἀρχὴν τοῦ Κορινθιακοῦ κόλπου μέχρι ἄκρας Ἀράξου, καθ' ἣν ἀντίπορθμός ἐστιν ἥ τε Ἀκαρνανία καὶ αἱ προκείμεναι νῆσοι, Ζάκυνθος καὶ Κεφαλληνία καὶ Ἰθάκη καὶ [αἱ] Ἐχινάδες, ὧν ἐστι καὶ τὸ Δουλίχιον.*

[138] *Ἰθάκη, νῆσος πρὸς τῇ Κεφαλληνίᾳ ἀπὸ Ἰθάκου [ἥρωος], ἀφ ἧς Ὀδυσσεύς.*

[139] Porphyry *περὶ ἄντρου Νυμφῶν* cap. 4. *τῆς δὲ Κεφαλληνίας ἀπὸ Πανόρμου λιμένος πρὸς ἀνατολὴν δώδεκα στάδια, νῆσός ἐστιν Ἰθάκη . . . . λιμένα ἔχουσα καλούμενον Φόρκυνα.*

[140] See pp. 3 *sqq.*

one would expect it to be from the statements about it in the Homeric poems. It is near enough to the mainland to make it entirely natural that Odysseus should have herds[141] and flocks there, especially when we remember that the territory of the Cephallenians, over whom Laertes, the father of Odysseus, was king, included a portion of the mainland.[142] It is visible from the coast of Elis,[143] and is near enough to it to make it very natural for a citizen of Ithaca to have mares pasturing there.[144] The journey from Pylus to Ithaca may well be made in one night, whichever location may be correct for Pylus.[145] Further, its general features correspond to those of Homeric Ithaca. It is far-seen[146] and imposing,[146] since it contains two mountains, Anogi in the northern part, with an elevation of 2,645 feet, and Hagios Stephanos in the southern part, with an elevation of 2,200 feet. Besides, it is rough[147] and rocky,[147] has not good meadows,[147] and in the whole island there is not enough level ground to furnish a driving course for horses.[147] Furthermore, the island is a narrow[147] one, being no more than four miles wide at any point, and is cut almost in two in the middle by the gulf of Molo. Again, it produces wine, figs, grapes, and olives,[147] and, if it is not as fertile now as Homer represents it, and has not so many perennial springs, that is due to the loss of trees, as a result of which its soil has been washed away. This the island has suffered with the mainland of Greece. Besides, it is on the way from Thesprotia to Dulichium,[148] whichever location is assigned to the latter, and satisfies the conditions of Telemachus's return from Pylus.[149] Athena instructs him to keep his ship off the islands and to land at the nearest point of Ithaca. This advice is given to prevent his being intercepted by the suitors, who are lying in wait for him in the strait between Ithaca and Samos. He is expected to return by way of Zacynthus, Samos, and the strait between the latter and Ithaca. Zacynthus and Samos, therefore, are the islands that Athena advises him to

[141] See p. 9. [144] See p. 8. [147] See p. 12.
[142] See p. 4. [145] See p. 7. [148] See p. 9.
[143] See p. 5. [146] See p. 9. [149] See p. 5.

avoid. At any rate, he does avoid them. Sailing from Pylus, he goes past Crouni and Chalcis, draws near to Pheæ, and, coasting along Elis, makes for the Pointed Isles. Thence he goes straight across to the nearest point of Ithaca, where he lands and makes his way to the swineherd's house, thus avoiding the suitors, who are on the other side of the island. The Pointed Isles are those of the Echinades near the entrance to the Corinthian gulf and the mouth of the Achelous river, according to Strabo.[150] Pliny also calls certain of the islands between Leucadia and Achæa, Oxiæ.[151] These are probably the same as the *νῆσοι Θοαί*. Further, Strabo says that the Achelous river was formerly called *Θόας*.[152]

Zacynthus still exists. It remains, therefore, to identify Samos. In the *Odyssey* the island is called either Samos or Same.[153] From it come twenty-four suitors [153] to woo Penelope, and Ctimene, when she grows up, is sent there to be married.[153]

Further, it is separated from Ithaca by a strait narrow enough for the suitors reasonably to expect, by lying in wait in it, to

[150] Strabo VIII. 3, 26: *θοὰς δὲ εἴρηκε τὰς ὀξείας· τῶν Ἐχινάδων δ' εἰσὶν αὗται, πλησιάζουσαι τῇ ἀρχῇ τοῦ Κορινθιακοῦ κόλπου καὶ ταῖς ἐκβολαῖς τοῦ Ἀχελώου.*

[151] Pliny, *N. H.* IV. 12, 19: Inter Leucadiam autem et Achaiam permultae, quarum Teleboïdes eademque Taphias, Carnos, Oxiae.

[152] Strabo X. 2, 1: *ἐκαλεῖτο δὲ Θόας ὁ Ἀχελῶος πρότερον.*

[153] (*a*) *Od.* I. 245 *sqq.*:

ὅσσοι γὰρ νήσοισιν ἐπικρατέουσιν ἄριστοι,
Δουλιχίῳ τε Σάμῃ τε καὶ ὑλήεντι Ζακύνθῳ,
* * * * * * * *
τόσσοι μητέρ' ἐμὴν μνῶνται, τρύχουσι δὲ οἶκον.

(*b*) *Od.* IV. 670 *sq.*:

ὄφρα μιν αὐτὸν ἰόντα λοχήσομαι ἠδὲ φυλάξω
ἐν πορθμῷ Ἰθάκης τε Σάμοιό τε παιπαλοέσσης.

(*c*) *Od.* XVI. 249 *sqq.*:

ἐκ δὲ Σάμης πίσυρές τε καὶ εἴκοσι φῶτες ἔασιν,
ἐκ δὲ Ζακύνθου ἔασιν ἐείκοσι κοῦροι Ἀχαιῶν,
ἐκ δ' αὐτῆς Ἰθάκης δυοκαίδεκα πάντες ἄριστοι.

(*d*) In the following passage Same probably refers to the city. *Od.* XV. 366 *sq.*:

αὐτὰρ ἐπεὶ ῥ' ἤβην πολυήρατον ἱκόμεθ' ἄμφω,
τὴν μὲν ἔπειτα Σάμηνδε δόσαν καὶ μυρί' ἕλοντο.

intercept Telemachus on his return home from Pylus.[154] The island most likely to be the Homeric Samos is Cephallenia. The Homeric poems contain no mention of an island Cephallenia. The land of the Cephallenians is several times mentioned, but this is evidently no single island, but a large territory embracing both islands and parts of the mainland. In *Il.* II. 631 *sqq.*,[155] we are informed that the Cephallenians control Ithaca, Neriton, Crocyleia, Aegilips, Zacynthus, Samos, mainland, and region opposite the mainland. The cities of the Cephallenians are referred to in *Od.* XXIV. 353 *sqq.*,[156] where Laertes fears the information about the death of the suitors will be carried to the cities of the Cephallenians. Philœtius, the neatherd, says that Odysseus put him in charge of the cattle in the land of the Cephallenians when he was still a little fellow,[157] and that ferrymen brought him with a heifer and fat goats across to Ithaca by a ferry that brings other people also.[158]

The first mention of the island Cephallenia is in Herodotus, IX. 28,[159] where it is stated that two hundred inhabitants of the Cephallenian city Paleis fought with the rest of the Greeks at Platea. Further, Strabo[160] says that Samos is modern Cephallenia, and that it contained a city called Samos or Same. When, now, we reflect that Samos was one of the lands of the Cephallenians, that Philœtius was, when a boy, placed in charge of cattle in a land of the Cephallenians, from which he and others came over by ferry, and that between Ithaca and Samos there was a strait,[161] the conclusion

[154] See pp. 6 *sqq.* [155] See p. 4.

[156] *νῦν δ' αἰνῶς δείδοικα κατὰ φρένα, μὴ τάχα πάντες*
ἐνθάδ' ἐπέλθωσιν Ἰθακήσιοι, ἀγγελίας δὲ
πάντῃ ἐποτρύνωσι Κεφαλλήνων πολίεσσιν.

[157] See p. 7. [158] See p. 7, n. 20.

[159] *μετὰ δὲ τούτους, Λευκαδίων καὶ Ἀνακτορίων ὀκτακόσιοι ἔστασαν· τούτων δὲ ἐχόμενοι, Παλέες οἱ ἐκ Κεφαλληνίης διηκόσιοι.*

[160] Strabo X. 2, 10: *Σάμον δὲ τὴν νῦν Κεφαλληνίαν, ὡς καὶ ὅταν φῇ, "ἐν πορθμῷ Ἰθάκης τε Σάμοιό τε παιπαλοέσσης." . . . . τετραπόλεως γὰρ οὔσης τῆς νήσου μία τῶν τεττάρων ἐστὶν ἡ καὶ Σάμος καὶ Σάμη καλουμένη καθ' ἑκάτερον τοὔνομα, ὁμωνυμοῦσα τῇ νήσῳ.*

[161] See p. 6.

becomes irresistible that modern Cephallenia[162] is Samos, because it fulfils the conditions thoroughly, and is the only island that does fulfil them. It is near enough to Ithaca to make it natural that suitors should come from it to woo Penelope,[163] and that Ctimene should be sent there to be married.[164] Further, the strait between the two islands would be conveniently crossed by a ferry[165] from the city of Ithaca to some point on the other island, and its width is such that the suitors might reasonably expect to intercept Telemachus on his return from Pylus by keeping watch for him on an island in the midst of the strait.[166]

As to the island Asteris, if Ithaca and Cephallenia have been rightly explained, it must lie in the strait between the two. The only island in the strait at present is a mere rock called *Δασκαλειό*. This island was visited by Schliemann in 1864, and is described by him as 99 meters long, 32 meters wide at its widest part, only 2 meters above the water, and as having no harbor.[167] Many changes may have taken place in the island between the Homeric period and modern times, but the island as it now appears does not correspond to the requirements of the *Odyssey*, which represents it as having double harbors and windy heights, upon which the suitors sat by day and watched for Telemachus on his return from Pylus. Its position, too, aside from the location of the city Ithaca, is hardly what would naturally be expected when we are informed that at night the suitors did not remain on the island, but cruised about in the open sea.[168] From *Δασκαλειό* they must travel a long distance to reach the open sea (*πόντος*), for we can not interpret *πόντος* as meaning the strait between the two

[162] See Plates I and IV.

[163] See p. 41, n. 153 (*a*) and (*c*).

[164] See p. 41, n. 153 (*d*).

[165] See pp. 7 *sqq.*

[166] See n. 18.

[167] Schliemann, *Ithaka, Peloponnesus u. Troia*, p. 69.

[168] *Od.* XVI. 366 *sqq.*:

ἅμα δ' ἠελίῳ καταδύντι
οὔ ποτ' ἐπ' ἠπείρου νύκτ' ἄσαμεν, ἀλλ' ἐνὶ πόντῳ
νηὶ θοῇ πλείοντες ἐμίμνομεν Ἠῶ δῖαν
Τηλέμαχον λοχόωντες, ἵνα φθίσωμεν ἑλόντες
αὐτόν.

islands. From this passage one would expect the island to be at the southern end of the strait. Indeed, the island is too far north to intercept one on his way to Polis even, to say nothing of Ætos, which is the most probable location of the city Ithaca. If the island were at the southern end of the strait it would satisfy thoroughly all of the conditions of situation. In that case one must pass it in going to either Polis or Ætos, the places more commonly identified with the city Ithaca. Partsch[169] thinks from the geological evidence that in the Tertiary period Ithaca was joined to Cephallenia. If so, then in the process of separation an island such as Asteris may very naturally have been left in the passageway between the two islands at the lower end of Ithaca. The extreme frequency and violence of earthquakes in Cephallenia offer a satisfactory explanation of the disappearance of the island. The first earthquakes of which we have any extended notice occurred in 1612, 1613, 1625, and 1630. In 1636, September 30 (old style), a violent earthquake destroyed houses, loosed rocks from the mountains, and killed 520 people. Another in 1648 was felt in Ithaca and Zacynthus, as well as in the open sea. In 1658, August 12 (old style), 500 houses in Lixuri and 20 people were destroyed. During the next thirty days 300 people lost their lives. According to Riccioli, a hill with a church sank out of sight. In 1714, August 28 (old style), 280 houses were destroyed, and cracks appeared in the earth from which hot water issued. For two months the inhabitants lived out of doors. In 1723, February 9 (old style) and 11 (old style), severe earthquakes affected the whole of the southern group of the Ionian isles, Paliki and Erisos in Cephallenia suffering

[169] *Allgemeine Zeitung* 1888, Beilage zu Nr. 237: "Noch verwickelter müsste sein Umriss sich gestalten, wenn ausser dem im Westen angehängten Landarm der Halbinsel Paliki und der nach Norden lang ausgestreckten Felsenzunge von Erisos noch ein ursprünglich angefügter Bergrücken seinen Zusammenhang mit der Insel bewahrt hätte: das selbständig ihr im Nordosten vorgelagerte Eiland Ithaka. Noch erkennt man an der Vertheilung der tertiären Ablagerungen (Mergel und Gypse) den Zug einer alten Meeresfurche, welche zwischen Ithaka's und Eriso's Kalkgebirgen südwärts zog und dann in's Innere Kephalleniens eindrang, ohne dessen südöstliche Uferberge von Ithaka's Südende zu trennen."

most. From 1833 to 1867 earthquakes continued at frequent intervals, and in the latter year, February 3 and 4, an earthquake occurred in which, according to official reports, 2,642 houses were destroyed, 2,946 were badly damaged, 224 people were killed, and a loss of 15,000,000 drachmæ was sustained.[170] The supposition, therefore, that the island Asteris has disappeared as a result of earthquake, is by no means a violent one, but is reasonable.

In order to determine whether modern Ithaca furnishes a place corresponding to Eumæus's establishment, we shall give the facts about it as contained in the *Odyssey*. Eumæus's establishment is fully described in the passage, *Od.* XIV. 5 *sqq.*, which is here reproduced from Palmer's *Odyssey:*

He found him sitting in his porch, by which was built a high-walled yard upon commanding ground, a handsome yard and large, with space around. With his own hands the swineherd built it for the swine after his lord was gone, without assistance from the queen or old Laertes, constructing it with blocks of stone and coping it with thorn. Outside the yard he drove down stakes the whole way round, stout and close-set, of split black oak. Inside the yard he made twelve sties alongside one another, as bedding places for the swine; and fifty swine that wallow in the mire were penned in each, all of them sows for breeding; the boars, much fewer, lay outside. On these the gallant suitors feasted and kept their number small; for daily the swineherd sent away the best fat hog he had. Three hundred and sixty they were now. Hard by, four dogs, like wild beasts, always lay, dogs which the swineherd bred, the overseer. He was himself now fitting sandals to his feet, cutting therefor a well-tanned hide. The other men were gone their several ways: three with the swine to pasture; a fourth sent to the town to take the audacious suitors, as was ordered, a hog to slay and sate their souls with meat.[171]

[170] Partsch, *Kephallenia*, p. 27.

[171] *Od.* XIV. 5–28:

τὸν δ' ἄρ' ἐνὶ προδόμῳ εὗρ' ἥμενον, ἔνθα οἱ αὐλὴ
ὑψηλὴ δέδμητο, περισκέπτῳ ἐνὶ χώρῳ,
καλή τε μεγάλη τε, περίδρομος· ἣν ῥα συβώτης
αὐτὸς δείμαθ' ὕεσσιν ἀποιχομένοιο ἄνακτος,
νόσφιν δεσποίνης καὶ Λαέρταο γέροντος,
ῥυτοῖσιν λάεσσι καὶ ἐθρίγκωσεν ἀχέρδῳ.
σταυροὺς δ' ἐκτὸς ἔλασε διαμπερὲς ἔνθα καὶ ἔνθα
πυκνοὺς καὶ θαμέας, τὸ μέλαν δρυὸς ἀμφικεάσσας.
ἔντοσθεν δ' αὐλῆς συφεοὺς δυοκαίδεκα ποίειν

We may infer that it is in the southern part of the island, since Athena directs Telemachus, on his return home from Pylus, to land at the first point in Ithaca, send his ship to the city, and himself go first to the swineherd.[172] Presumably he follows her directions in full, as upon landing he orders his men to sail the ship to the city.[173] This they do, and he goes to the swineherd's.[174] This location is corroborated by a statement that Amphimedon, a suitor, makes to Agamemnon, that a divinity brought Odysseus to the extremity of the land where the swineherd dwelt.[175] An idea of the distance of

πλησίον ἀλλήλων, εὐνὰς συείν· ἐν δὲ ἑκάστῳ
πεντήκοντα σύες χαμαιευνάδες ἐρχατόωντο,
θήλειαι τοκάδες· τοὶ δ' ἄρσενες ἐκτὸς ἴαυον,
πολλὸν παυρότεροι· τοὺς γὰρ μνηνθεσκον ἔδοντες
ἀντίθεοι μνηστῆρες, ἐπεὶ προΐαλλε συβώτης
αἰεὶ ζατρεφέων σιάλων τὸν ἄριστον ἀπάντων·
οἱ δὲ τριηκόσιοί τε καὶ ἑξήκοντα πέλοντο.
πὰρ δὲ κύνες θήρεσσιν ἐοικότες αἰὲν ἴαυον
τέσσαρες, οὓς ἔθρεψε συβώτης, ὄρχαμος ἀνδρῶν.

[172] *Od.* XV. 36 *sqq.*:

αὐτὰρ ἐπὴν πρώτην ἀκτὴν Ἰθάκης ἀφίκηαι,
νῆα μὲν ἐς πόλιν ὄτρυναι καὶ πάντας ἑταίρους,
αὐτὸς δὲ πρώτιστα συβώτην εἰσαφικέσθαι,
ὃς τοι ὑῶν ἐπίουρος, ὁμῶς δέ τοι ἥπια οἶδεν.

[173] *Od.* XV. 503 *sqq.*:

ὑμεῖς μὲν νῦν ἄστυδ' ἐλαύνετε νῆα μέλαιναν,
αὐτὰρ ἐγὼν ἀγροὺς ἐπιείσομαι ἠδὲ βοτῆρας·
ἑσπέριος δ' εἰς ἄστυ ἰδὼν ἐμὰ ἔργα κάτειμι.

[174] *Od.* XV. 555 *sqq.*:

τὸν δ' ὦκα προβιβάντα πόδες φέρον, ὄφρ' ἵκετ' αὐλήν,
ἔνθα οἱ ἦσαν ὗες μάλα μυρίαι, ᾗσι συβώτης
ἑσθλὸς ἐὼν ἐνίαυεν, ἀνάκτεσιν ἥπια εἰδώς.

[175] *Od.* XXIV. 149 *sq.*:

καὶ τότε δή ῥ' Ὀδυσῆα κακὸς ποθεν ἤγαγε δαίμων
ἀγροῦ ἐπ' ἐσχατιήν, ὅθι δώματα ναῖε συβώτης.

Eumæus's place from the city is furnished by the circumstances of his visit to the city to report to Penelope the arrival of Telemachus. He goes to the city after breakfast[176] and returns the same day, arriving home while Odysseus and Telemachus are getting supper.[177] Afterwards, when Eumæus and the beggar go to the city, they depart late in the day, as Eumæus urges the beggar to start since the day is far gone and the evening will be disagreeable.[178] On their way they meet Melanthius at the spring near the city, and he is bringing goats for the suitors' dinner.[179] Leaving him, they reach the palace while the suitors are feasting. When evening comes on, Eumæus returns home.[180] The distance is further indicated by the fact that Telemachus tells his men, when he sends them to Ithaca with the boat after landing on the island, that he is going to visit the fields and the herdsmen, and will reach the city by night.[181] This would not be possible if the distance were great. Eumæus's place was not far

[176] *Od.* XVI. 154 *sq.*:

ἦ ῥα καὶ ὦρσε συφορβόν· ὁ δ' εἵλετο χερσὶ πέδιλα,
δησάμενος δ' ὑπὸ ποσσὶ πόλινδ' ἴεν.

[177] *Od.* XVI. 452 *sqq.*:

ἑσπέριος δ' Ὀδυσῆι καὶ υἱέι δῖος ὑφορβὸς
ἦλυθεν· οἱ δ' ἄρα δόρπον ἐπισταδὸν ὠπλίζοντο,
σὺν ἱερεύσαντες ἐνιαύσιον.

[178] *Od.* XVII. 190 *sq.*:

ἀλλ' ἄγε νῦν ἴομεν· δὴ γὰρ μέμβλωκε μάλιστα
ἦμαρ, ἀτὰρ τάχα τοι ποτὶ ἕσπερα ῥίγιον ἔσται.

[179] *Od.* XVII. 212 *sqq.*:

ἔνθα σφέας ἐκίχαν' υἱὸς Δολίοιο Μελανθεὺς
αἶγας ἄγων, αἳ πᾶσι μετέπρεπον αἰπολίοισιν,
δεῖπνον μνηστήρεσσι·

[180] *Od.* XVII. 604 *sqq.*:

βῆ ῥ' ἴμεναι μεθ' ὅας, λίπε δ' ἕρκεά τε μέγαρόν τε
πλεῖον δαιτυμόνων. οἱ δ' ὀρχηστυῖ καὶ ἀοιδῇ
τέρποντ'· ἤδη γὰρ καὶ ἐπήλυθε δείελον ἦμαρ.

[181] *Od.* XV. 504 *sq.*:

αὐτὰρ ἐγὼν ἀγροὺς ἐπιείσομαι ἠδὲ βοτῆρας·
ἑσπέριος δ' εἰς ἄστυ ἰδὼν ἐμὰ ἔργα κάτειμι.

from the coast. Telemachus lands at dawn[182] and arrives at Eumæus's place while he and Odysseus are preparing breakfast in the early morning (ἅμ' ἠοῖ).[183] Near the swineherd's house was Raven rock and a spring, Arethusa, by which the swine fed.[184] This rock or cliff is doubtless referred to by the beggar when he proposes that, in case Odysseus does not return in accordance with his prediction, Eumæus shall have his servants cast him down from a huge rock.[185] Possibly at the foot of Raven rock there was a cave in which swine lay at night. At any rate, Eumæus goes out to sleep where the swine lay under a hollow rock protected from the north wind.[186] In the southeastern part of modern Ithaca there is a place called Marathia, which corresponds in a very striking manner to the description of Eumæus's establishment as outlined above. There is a plain of considerable extent terminated on the eastern side by a steep cliff. This is about a mile from the sea. Half way between the cliff and the sea is a spring of never-failing water. On the coast east of this region is the bay of Ligia. We have here, then, a place at the extremity of the land, in the southern part of the island, not far from the coast, presenting a cliff corresponding to Raven rock, a spring near by, and a hollow rock under which Eumæus

[182] *Od.* XV. 495 *sqq.*:

αἶψα γὰρ Ἠὼς ἦλθεν ἐύθρονος. οἱ δ' ἐπὶ χέρσου
Τηλεμάχου ἕταροι λύον ἱστία, κὰδ δ' ἕλον ἱστὸν
καρπαλίμως, τὴν δ' εἰς ὅρμον προέρεσσαν ἐρετμοῖς.

[183] *Od.* XVI. 1 *sq.*:

τὼ δ' αὖτ' ἐν κλισίῃ Ὀδυσσεὺς καὶ δῖος ὑφορβὸς
ἐντύνοντ' ἄριστον ἅμ' ἠοῖ, κηαμένω πῦρ.

[184] *Od.* XIII. 407 *sq.*:

δῆεις τόν γε σύεσσι παρήμενον· αἱ δὲ νέμονται
πὰρ Κόρακος πέτρῃ ἐπί τε κρήνῃ Ἀρεθούσῃ.

[185] *Od.* XIV. 398 *sq.*:

εἰ δέ κε μὴ ἔλθῃσιν ἄναξ τεός, ὡς ἀγορεύω,
ὄμῳας ἐπισσεύας βαλέειν μεγάλης κατὰ πέτρης.

[186] *Od.* XIV. 532 *sq.*:

βῆ δ' ἴμεναι κείων, ὅθι περ σύες ἀργιόδοντες
πέτρῃ ὕπο γλαφυρῇ εὕδον, Βορέω ὑπ' ἰωγῇ.

slept with the swine. We have also in the bay of Ligia the harbor in which Telemachus landed and then went to Eumæus's hut after sending the ship to the city.[187] Its distance from Marathia corresponds well with that implied in the statements in Homer,[188] that Telemachus landed at dawn and reached Eumæus's place while he and the beggar were preparing breakfast in the early morning.

North of Marathia, at a distance of two to two and a half miles is the harbor of Vathy, which corresponds to the Homeric description of Phorcys harbor, with the exception of the Nymphs' cave. It is a deep, well protected, safe harbor, and from it Anogi is visible, which represents Neriton.[189] From this harbor Odysseus makes his way to Eumæus's place over a rugged road.

The island furnishes a site that satisfies the conditions of the city of Ithaca. This is Ætos, on the narrow isthmus that connects the northern and southern parts of the island. The harbor is not far off, and is clearly visible from it. The site is on an elevation at the foot of the mountain Hagios Stephanos that corresponds to Neion, and below one of the lower hills of the same mountain which corresponds to Hermes hill. In the early part of the last century there was a large spring on the slope of the hill corresponding to the spring at which Eumæus and the beggar met Melanthius. This location corresponds to the Homeric account in being on the strait between Ithaca and Cephallenia, which, as we have seen above, is the ancient Samos.[190] The harbor of Exo-Ætos is, doubtless, the harbor in which the suitors launched their ship, and to which they returned after their vain attempt to intercept Telemachus in the strait between Ithaca and Cephallenia, while the gulf of Molo is the harbor into which Telemachus's ship enters on its return to the city after leaving him at the harbor of Ligia.

The other harbor from which one might come to the city of Ithaca is Reithron. To this the little harbor of Dexia cor-

[187] See Plate IV.

[188] See p. 48, notes 182 and 183.

[189] See Plate IV.

[190] See pp. 42 *sqq.*

responds, situated just west of the harbor of Vathy. It corresponds to the Homeric account in being on the edge of the fields, outside of the city, and at the foot of Hagios Stephanos (Neion).[191]

This site is located with reference to Marathia in such a way as to satisfy thoroughly the conditions of the relation of the city to Eumæus's establishment. From Marathia Eumæus could go to the city and back the same day.[192] The distance between the two is such that Telemachus could go from Ligia to visit the fields and the herdsmen, and yet reach the city by night.[193] Eumæus and the beggar could easily reach the city about noon from Marathia,[194] and Eumæus would be able after spending the afternoon at the palace to depart about evening and yet reach home that night.[195] Furthermore, Eumæus and the messenger from Telemachus's ship would naturally reach the palace at about the same time,[196] Eumæus going on foot through the country and the messenger from the ship which had sailed from the harbor of Ligia into that of Molo on the eastern side of the island.

The modern Polis, in the northwestern part of the island which is taken by Leake and others to be the site of the ancient city Ithaca, does not satisfy the conditions so well. It is, to be sure, on the strait between Ithaca and Cephallenia (Samos), so that the suitors would naturally lie in wait for Telemachus in the strait, and a ferry might well be run between it and some point of Cephallenia. But it does not sustain the proper relation to the swineherd's establishment. Telemachus could hardly visit the fields and the herdsmen and then reach Polis by night. Eumæus would find it a long journey to go to Polis from Marathia and return the same day. Eumæus and the beggar could hardly reach the city at Polis by noon; and the former would hardly reach home at a seasonable hour at night if he did not start from Polis until evening.

As to Laertes's farm, it was in all probability near Leuka

[191] See Plate IV. [192] See p. 47. [193] See p. 47. [194] See p. 47. [195] See p. 47. [196] *Od.* XVI. 333 *sqq.*

in the northern half of the island. From the Homeric account we have little information as to its location. It seems, however, to have been at some distance from the city, and in all probability was beyond the city from Eumæus's place.[197] These conditions are fulfilled by the site mentioned above. It must be admitted that there are certain difficulties in accepting modern Ithaca as Homeric Ithaca. Some are apparent only, others are real. In this connection the passage in which Odysseus describes to Alcinous his home[198] is important. He says that Ithaca is far-seen, having a mountain in it, imposing Neriton with waving foliage. This may seem to be contradicted by a statement further on in the same passage to the effect that Ithaca is low; but the latter is to be understood in a relative sense, Ithaca being lower than Cephallenia and Zacynthus, two of the islands mentioned as situated around it.

He says, further, that there are many islands about Ithaca very near each other, among which are Dulichium, Same, and Zacynthus; that Ithaca itself lies low and furthest out to sea toward the west, while the other islands lie apart toward the east. Zacynthus still exists, Samos is modern Cephallenia,[199] and Dulichium was probably off the coast of Acarnania at the mouth of the Achelous river.[200] At present there are not many islands about Ithaca very near each other, but the disappearance of the islands referred to may be explained by the frequent violent earthquakes which this region has suffered.[201] Again, Ithaca does not lie furthest west, and the other islands apart toward the east. The most plausible explanation of this statement is offered by Partsch.[202] He says that in all periods there has been an inclination to regard the line of direction of the Ionian islands as east instead of southeast or south. In reference to Corfu a false orientation has come down to the present time through Strabo, Ptolemy,

[197] See pp. 19 *sqq.*

[198] *Od.* IX. 21 *sqq.* See p. 9.

[199] See pp. 42 *sqq.*

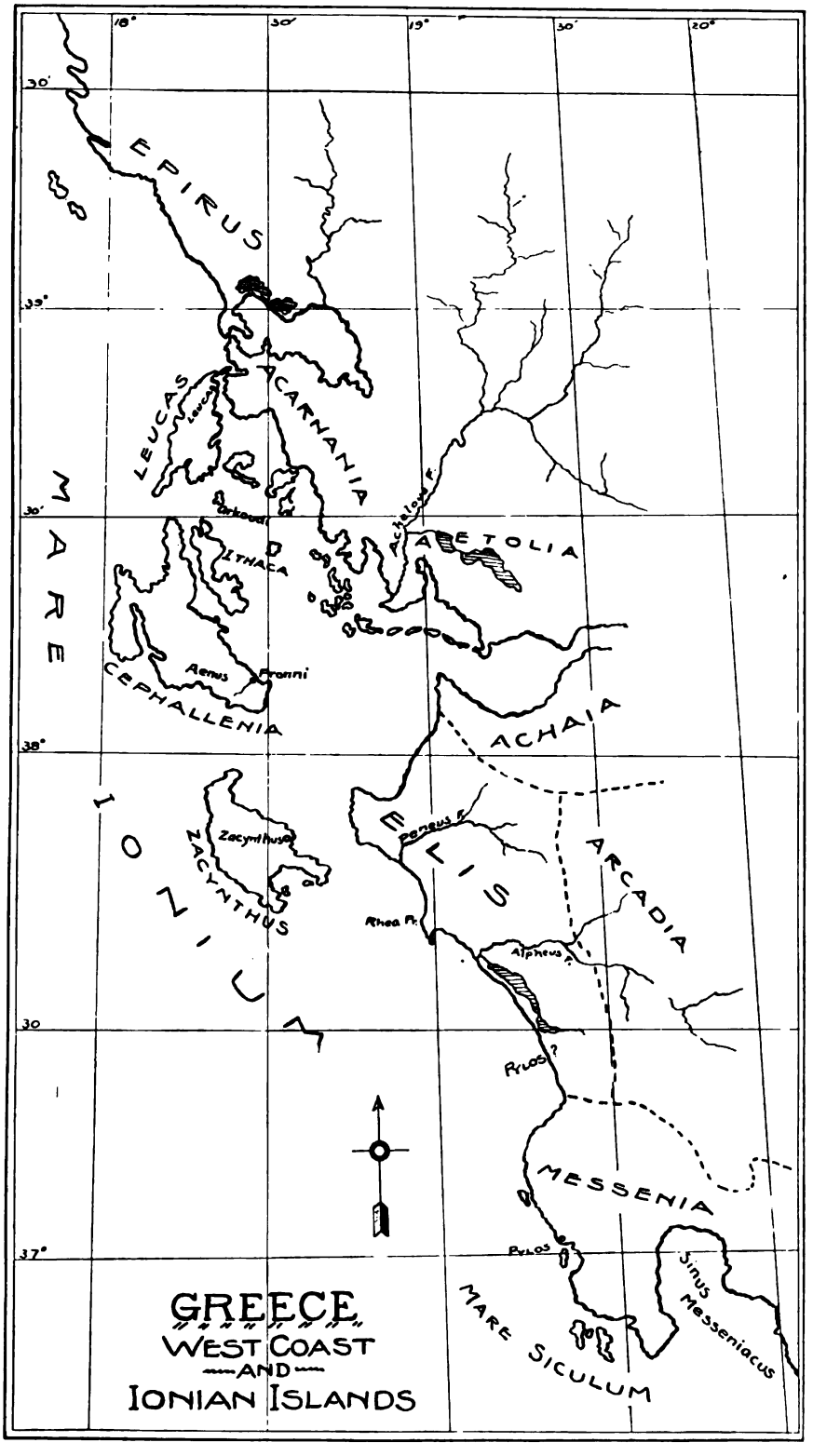
[200] See pp. 11 *sqq.*

[201] See pp. 44 *sqq.*

[202] J. Partsch, Ergänzungsheft Nr. 89 to *Petermann's Mitteilungen*, 1890, "Kephallenia" pp. 56 *sqq.*

and authorities of the Middle Ages and modern times, by which the north end of the island is regarded as the west end and the southern point as the east end. Even today in the official naming of two demes in Corfu the same error is seen. One is on the north and the other on the south side of the principal mountain in the island, but they are contrasted by name as western and eastern. The voyage from Corfu by Paxos to Leucas is regarded by Bondelmonte as in an eastern direction, and the report of a victory by a Venetian admiral distinguishes the northern and southern sides of the lagoon of Santa Maura as "banda di ponente and banda di levante."

The Leucadian poet Valauritis regards the northwest corner of Maganisi as the southwestern. Similar confusion is found in Cephallenia, Bondelmonte placing the convent Lisia on the east coast when it is on the south coast, and the north point, with Port Phiskardo, at the west end of the island. He further considers Ithaca as extending from east to west. Even Dodwell locates as on the west of Neritos a place that is north. In Ithaca the same confusion of direction exists, a boy referring to the northwestern part of the island as the southern. Partsch regards the poet's point of view as lying somewhere on the coast of Elis. From this position he thinks Ithaca would appear furthest west, since the southern point of Cephallenia extends 30 kilometers south of that of Ithaca. But, even if explanations of these difficulties make one hesitate to believe that modern Ithaca is undoubtedly Homeric Ithaca, there can be no doubt that greater difficulties exist in Leucas than in Ithaca, and that only the most convincing evidence should be allowed to displace Ithaca in favor of Leucas. Until some better claimant than either is produced, the traditional view, unbroken throughout recorded history, must be maintained.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Rhea Fr.
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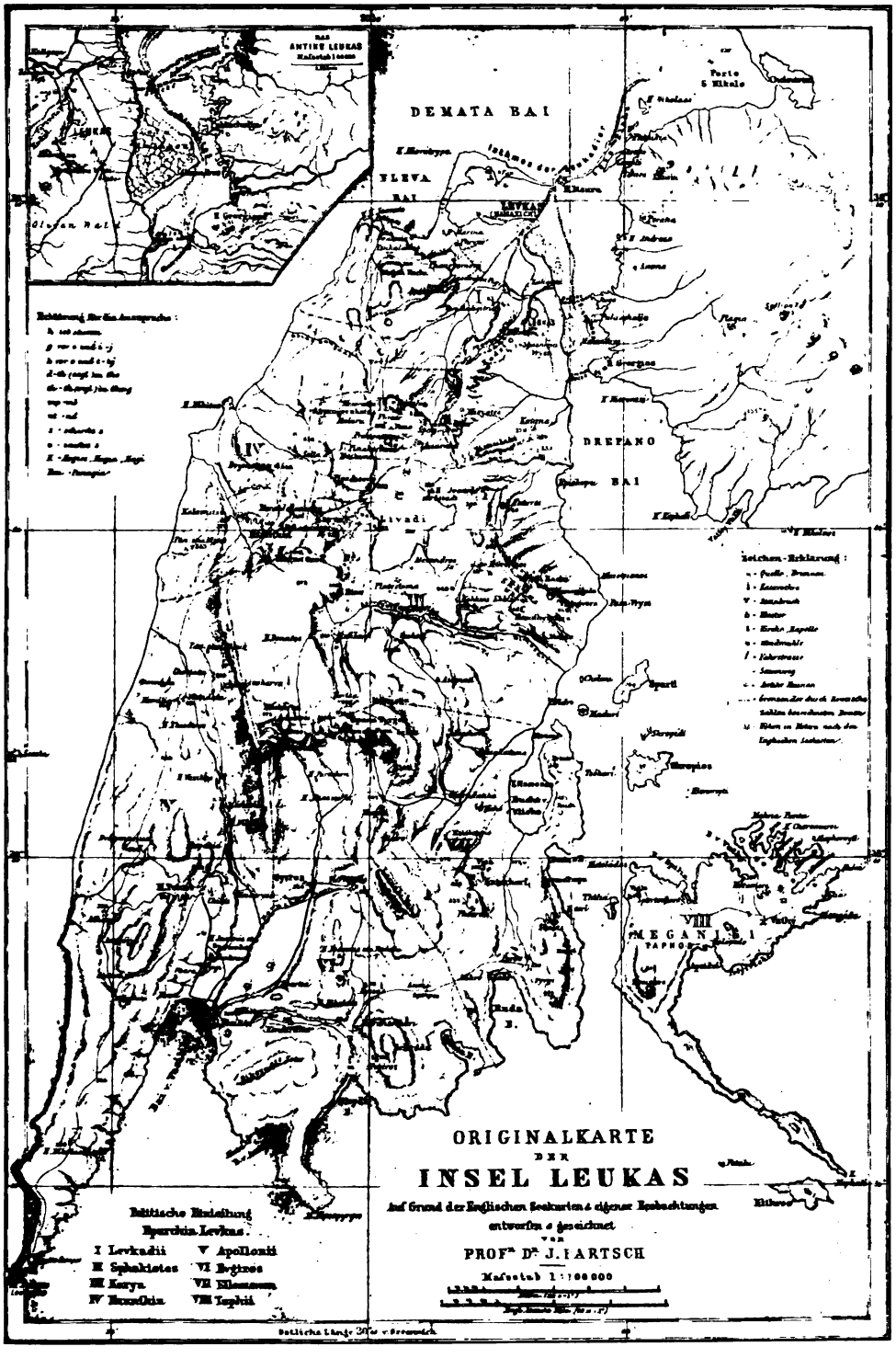
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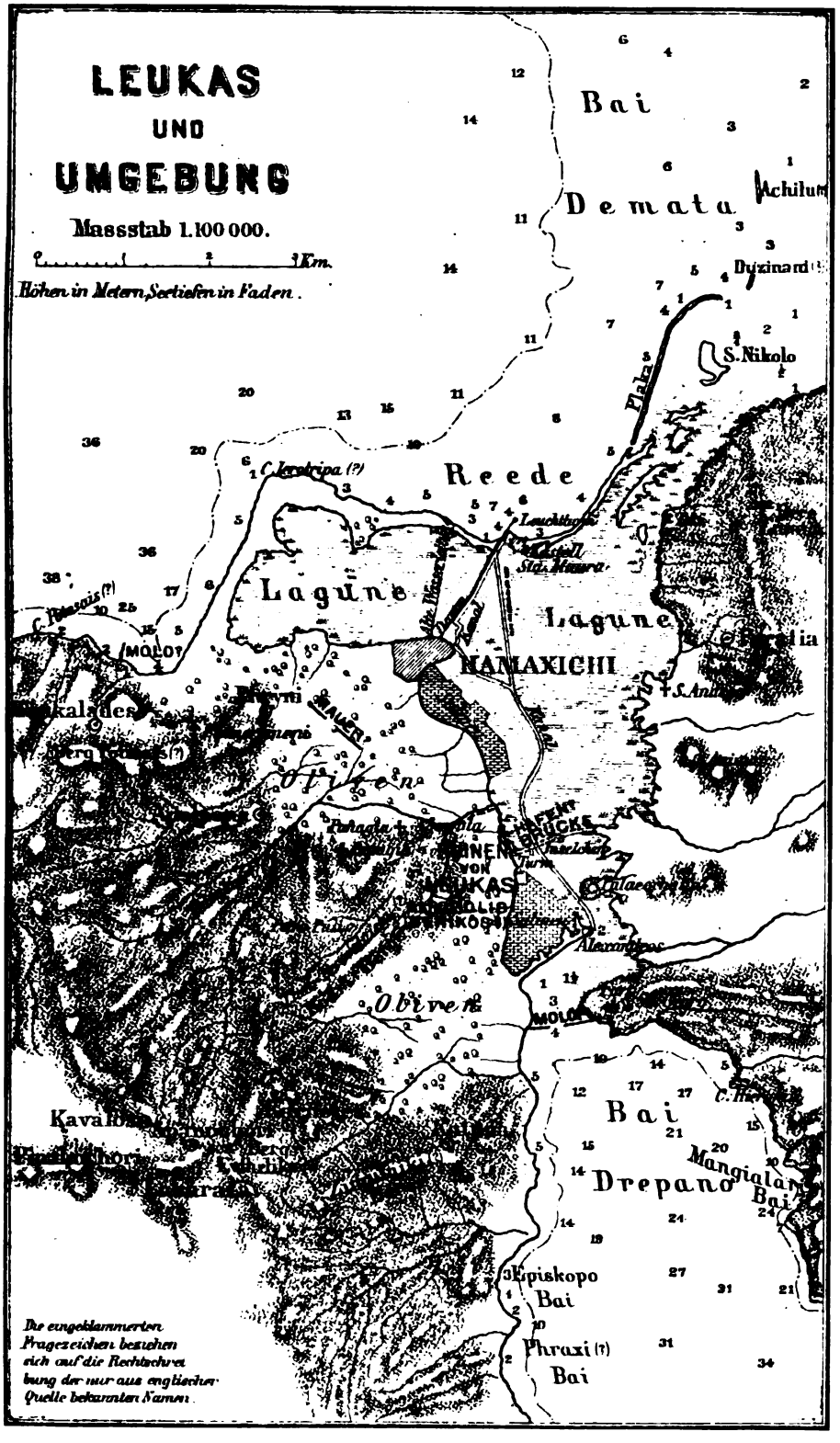
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PREFACE

The following monograph was written as a part of an encyclopedic work on *Public Relief and Private Charity in Modern Countries*, which will shortly appear under the general editorship of Professor C. R. Henderson, of the University of Chicago, and Dr. Emil Münsterberg, of Berlin. It must be read in the light of this fact. It does not aim to be an exhaustive treatise on the English Poor Law, therefore, but rather to present as a unit the whole system of public and private charity in England—a task which, I believe, has not been heretofore attempted. Many minor omissions were necessary on account of the limits of the space assigned me; some other omissions unfortunately are due to the poor library facilities under which I was compelled to do my work.

Thanks are due to Professor Henderson for his courtesy in permitting this monograph to appear in this form. My indebtedness to others who have written on various phases of English poor relief is acknowledged at different places in the text, and also in the list of authorities given in the bibliography at the end of the monograph.

C. A. E.

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PUBLIC RELIEF AND PRIVATE CHARITY IN ENGLAND

CHAPTER I

Historical Introduction

The history of poor relief in no country is so instructive and valuable to the student of modern philanthropic problems as in England. For the history of poor relief in England presents a continuous evolution whose successive phases exhibit at work all the forces and principles to which the modern science of philanthropy has given a theoretic formulation. Moreover, in England poor relief has been organized and supervised by the central authorities of government now for nearly three-quarters of a century to an extent scarcely equalled in any other country. On this account, the administrative problems which necessarily arise through governmental interference with the relief of the poor are perhaps most advantageously studied in English experience. But as the main object of this article is to present the existing system of public and private relief in England, our chief reason for reviewing the historical development is to throw light on the present system. The present complex

organization of public relief in England, with the supporting legislation, can not easily be understood without some knowledge of its evolution. Accordingly, as an introduction to the study of the present system of public relief, we shall present a brief résumé of its historical development. Only a few of the numerous enactments which have constituted the Poor Law at different periods can be noticed—enough merely to indicate the various stages of its evolution.

1. Poor Relief in the Medieval Period. While feudalism flourished there was comparatively little need of public relief. The mass of the people were serfs, bound to the soil, and were looked after by their feudal lords quite as slaves by their masters. What little destitution there was, which was mainly in the towns, was relieved by the Church,[1] chiefly through two institutions, the Monastery and the Hospital. With the decay of feudalism the burden of the Church in caring for the poor became vastly increased, but it continued to fulfill its function as the public relief agency more or less satisfactorily until the Reformation. The methods which the Church employed in relieving destitution were, however, such that they often aggravated rather than remedied the evil. Around the monasteries and throughout the country there gradually grew up a large dependent class who looked to those institutions for their support. Fuller's remarks in this connection

[1] Originally in England as on the Continent a part of the tithes (one-third or one-fourth) was regularly devoted to the relief of the poor. But this custom seems early to have been departed from, though a law of Ethelred attempted to enforce it as late as the Eleventh century. Thus the relief of the poor became mainly the work of the monasteries and hospitals. See Ratzinger's *Geschichte der kirchlichen Armenpflege*; Uhlhorn's *Christian Charity in the Early Church*; and Ashley's *English Economic History*.

are abundantly justified by historical research:[2] "Yea, those abbeys did but maintain the poor which they made. For some vagrants, accounting the abbey alms their own inheritance, served an apprenticeship and afterwards wrought journey work to no other trade than begging." As for the hospitals, which were in the Middle Ages but little more than endowed ecclesiastical almshouses, for the reception of both the destitute sick and the aged, they multiplied in number, so that before the Reformation there were some four hundred and sixty of these charitable institutions in England, many of them exceedingly wealthy.[3] Thus the Church was caring for no inconsiderable proportion of the population of England at the beginning of the Reformation. It is not surprising, therefore, that the dissolution of the monasteries under Henry VIII, revealed[4] such a mass of pauperism and vagrancy that to deal with it became one of the first problems of the statesmen of the Sixteenth century.

[2] There can be no doubt that the indiscriminate charity practiced by both the monasteries and hospitals was directly responsible for the production of a large class of vagrants and mendicants both in England and on the Continent. The apologists of the system of church charity have often denied this, pointing out other causes that co-operated in the production of this class. The existence of other causes may be admitted, of course, without giving up the position of the text, that the indiscriminate methods of relief employed by the Church were evil in their consequences, increasing rather than lessening the class of dependents. In this connection consult Ashley's *English Economic History*, pp. 307-324, vol. II; for the Catholic point of view, see Ratzinger's *Geschichte der kirchlichen Armenpflege*.

[3] Ashley, *English Economic History*, p. 318, vol. II.

[4] "Revealed," not "caused," as Ashley points out. The causes lay in the social conditions of the time and in the indiscriminate charity so long practiced by the Church.

Other methods of caring for the poor in later medieval times can be merely mentioned. One was the help given by the Guilds to their poorer members.[5] Another was of course through the private charity of the rich, especially of the nobles. This became considerable in later times, and, like the charity of the Church, was wholly indiscriminating and, therefore, evil in its consequences. Practically, indeed, it may be regarded as but one phase of the charity of the Church; for the motive of such giving was the Church's inculcation of the doctrine that almsgiving was a means of grace to the giver.[6]

2. THE PERIOD OF REPRESSION. The beginning of this period may be dated as early as the middle of the Fourteenth century, when the decay of feudalism first began to be manifest. Nothing was more natural than that laws should be passed to keep the laborer in the state of servitude from which he was just emerging. Accordingly, during the Fourteenth and Fifteenth centuries we find numerous labor statutes[7] enacted to fix the rate of wages and to prevent laborers from moving about in search of better pay. This legislation regarding the laboring classes involved as one of its necessary phases repressive meas-

[5] See Ashley, *English Economic History*, pp. 324-328, vol. II.

[6] That the Church encouraged indiscriminate private charity has been denied by some recent Catholic scholars. It is true that many theologians of the Church taught the duty of investigation and that indiscriminate charity was evil. But the enlightened views of these few did not affect the belief or the practice of the masses of the Church. With these, as Uhlhorn remarks, "the principal aim [in giving] remained to win for themselves the favor of God, not to combat or mitigate poverty."

[7] The first of these statutes was the so-called "Statute of Laborers," enacted in 1349. It forbade the giving of alms to "valiant beggars," but made no reference to the impotent poor. See Nicholl's *History of the English Poor Law*.

ures against vagrancy; and these measures mark the first steps in governmental interference in the relief of the poor.

Thus, the labor statute of 1388 (12 Richard II.), after providing for persons able to work, enacted, "that beggars impotent to serve shall abide in the cities and towns where they be dwelling at the time of the proclamation of this statute." This is the first mention we find in legislation of the impotent poor as a distinct class. No provision is made for their relief, but the principle of local responsibility for their care seems to be recognized. The same act provided that vagrants "able to serve or labor" were to be put in the stocks and kept there until they could give surety of returning to service or to their own neighborhood. Other enactments of a similar nature were made in the Fifteenth century, but vagrancy, as the laws themselves show, continued to flourish.

With the dissolution of the monasteries in the reign of Henry VIII., the evil became greatly aggravated. Severe vagrancy laws were enacted, and at the same time the distinction between the "impotent poor," those unable to work, and the "sturdy beggars," was more clearly drawn. Even earlier than this, however, the system of ecclesiastical poor relief had broken down, so that in legislating against vagabondage and vagrancy some provision for the relief of the impotent poor was made necessary. Thus the elaborate Act of 1530 "concerning the punishment of beggars and vagabonds" (22 Henry VIII.),[8] provided that the justices of the peace should give a kind of certificate or license to such impotent poor as could go begging, by which they were allowed to beg within a certain prescribed area, but if caught begging without a license, or outside these limits, they were to be whipped. This attempt to provide for

[8] See Nicholl's *History of the English Poor Law*, pp. 115-120, vol. I.

the impotent poor, through tolerating their begging upon certain conditions, shows not only a greater tendency to discriminate and a more humane spirit, but also that the charity of the Church was regarded as insufficient for the relief of this class. Able-bodied persons if caught begging, on the other hand, were to be whipped and returned to their place of birth, or where they had last lived for three years. For a second offense they were to have their ears cropped, and if caught begging a third time they were to be tried as felons and, if convicted, hanged. Moreover, any person who harbored or gave money to an able-bodied beggar was to be fined by the justices.

This Act of 1530 was, then, almost wholly repressive in its features; its sole object was to limit begging as much as possible, while recognizing that the charity of the Church was insufficient for the relief of the impotent poor. Positive measures for the relief of the poor are found first in an act passed some five years later (27 Henry VIII.).[9] This act provided that the mayor of every town, and the churchwardens of every parish, were to collect alms every Sunday, so that "the poor, impotent, sick, and diseased people, being not able to work, may be provided, holpen and relieved; and that such as be lusty, having their limbs strong enough to labor, may be daily kept in continual labor." In other words, the impotent poor were to be relieved by voluntary alms collected by the civil authorities of the towns, and the churchwardens of the parishes, while the able-bodied poor were to be set at work with funds secured in the same way. Moreover, an account was to be kept by the parish authorities of the sums collected and of the way in which the money was spent. It was expressly declared that the

[9] For this reason Ashley calls this act the "real commencement" of the Poor Law. See Ashley's *Economic History*, pp. 333, 337, vol. II.

alms were not compulsory, but the giving of private alms by an individual was forbidden upon pain of forfeiting ten times the amount given.[10] The whole tenor of the act was to revitalize the system of church charity. It in no way secularized relief. The exhortations of the clergy were to secure the funds for relief; the collectors of the funds were mainly church officers; and they were also the dispensers of relief. However, in this statute the State for the first time undertakes to direct how the relief of the poor shall be administered and how the funds for relief shall be raised; it further establishes the responsibility of the parish for the relief of its own poor. The act, therefore, marks the transition from an ecclesiastical to a secular system of poor relief. While it recognized the Church as the established relief agency, it attempted to direct and aid the Church in the performance of its duty.

Again in the reign of Edward VI. the vagrancy laws were made more cruel than ever,[11] and provision was made for the compulsory removal of beggars from all parts of the kingdom to the parishes where they had legal residence. A further amelioration in the laws dealing with the helpless poor, however, is marked by the Act of 1551. This act directed that in order to provide for "the impotent, feeble, and lame, who are poor in very deed," two or more collectors of alms were to be appointed in each parish, who were to make lists of the poor to whom grants were to be made. These collectors as well as the clergy of the parish were to "gently exhort and admonish," all parishioners to contribute according to their means. If any

[10] Nobles, prelates and friars, however, were exempt from this prohibition of private almsgiving. For the provisions of the act as a whole see Nicholl's *History of the English Poor Law*, pp. 121-125, vol. I.

[11] In 1547 it was enacted that a sturdy beggar might be made a slave for two years, and if he ran away a slave for life.

parishioner refused to pay what was expected of him, the bishop of the diocese was to exhort and reprove him.

It is evident that throughout this period the relief of the poor was still considered a function of the Church. The interferences of the Government in poor relief were mainly on the side of the repression of vagrancy and mendicity, which were considered civil matters. Other interferences were designed largely to aid and guide the Church in the performance of its important function. But the civil authority was not used to enforce this part of the legislation save in rare instances; thus the amounts assessed for the support of the poor by the collectors mentioned in the last paragraph, could not be enforced except by ecclesiastical censure.[12]

3. THE POOR LAWS OF ELIZABETH. Early in the reign of Elizabeth (1562) an attempt was made to increase the amount of the funds raised for relief, by directing the bishops to bind over all who refused to pay the amounts assessed by the parish collectors to appear before the justices at quarter sessions, who should assess their contributions at such sums as they thought reasonable. This is the first instance in which we have the authority of the Government used to enforce the collection of alms, and so an approach to a compulsory poor rate levied by civil authorities.

It soon became evident that the Church could no longer satisfactorily perform its ancient function of collector and dispenser of relief. Gradually, through numerous acts, the whole system of relief was transferred from the ecclesiastical to the civil authorities. In 1572 an act[13] was passed to appoint col-

[12] The best work on this period as well as on the Elizabethan period of Poor Law History is Miss E. M. Leonard's *Early History of English Poor Relief.*

[13] 14 Elizabeth.

lectors and also overseers of the poor in each parish who should tax the inhabitants "to such weekly charge" as there was need. In 1576 it was enacted that a stock of wool, flax, iron, and other stuff should be kept in each town by the collectors and governors of the poor, on which they might be set at work. If any poor person, who was able-bodied, refused to work, he was to be sent to a house of correction. And the act further provided that the funds necessary for all these purposes should be raised by taxation. Other enactments followed, and in 1597 something like an organic poor law was attempted. The appointment of overseers of the poor in each parish was provided for, who were to have charge of relief and raise by taxation the sums necessary for relief or the purchase of material for labor, while begging either by license or without was forbidden.

These acts culminated in the famous statute of 1601 (43 Elizabeth), which has remained to this day the foundation of English Poor Law. This great act was but an elaboration of the principles and machinery worked out in the experience of the preceding forty years. Indeed, the Act of 1597[14] contained all of the essential provisions of the statute of 1601, which, nevertheless, deserves the prominence given to it by all writers upon the Poor Law, as it represents the final form given the Poor Law by Elizabethan legislation.

From the standpoint of our much more complex social evolution, the main provisions of the law of 1601 seem exceedingly simple. It divided the recipients of relief into three classes: the able-bodied, those unable to work, and children. For the first, work was to be furnished, and to this end stores of flax, hemp, wool, iron, and other stuff were to be provided

[14] See Miss Leonard's comparison between the two acts, *Early History of English Poor Relief*, pp. 134, 135.

by the overseers. Refusal to work on the part of an able-bodied person was to be punished by the stocks or imprisonment. For those unable to work, necessary relief was to be provided, but only one sort of relief is commended, namely, maintenance in almshouses. Children, parents, and grandparents were also made liable for the support of this class. Dependent children were to be cared for by apprenticing them out—the boys till they were twenty-four and the girls till they were twenty-one, or married.

The funds for poor relief were to be raised by a tax, which the overseers were to levy and collect weekly, or otherwise, from every possessor of lands, houses, or tithes in the parish "in such competent sums as they shall think fit." If a parish were overburdened by its poor rate, the other parishes of the same hundred or county were to "rate in aid."[15]

The administration of the poor relief, as before, was left to the parish and was managed by two or more overseers of the poor who were to be nominated in every parish by the justices of the peace in Easter week. The supervision of the administration of the Poor Law was left to the justices of the peace.

Concerning the Poor Law of Elizabeth, there have been many opinions. Some have considered it to be "a perfect model of what all Poor Laws ought to be;"[16] others have thought it a failure. A saner judgment would seem to be that it was adapted to the situation of the time, though by no means a model for all time. That it was admirably fitted to the then existing social and political condition of England, is shown by

[15] That is, wealthy parishes were to tax themselves to aid the poorer parishes of the same county or hundred.

[16] See *The English Poor Laws* by Miss Sophia Lonsdale.

the fact that it worked well with few alterations for over a century and a half. Being the outcome of long experience, it necessarily rested upon some principles of universal validity; and these principles were rightly emphasized by the reformers of 1834. But to recognize this is different from finding in it a model for all time; it rather accords with the view that the law of 1601 marks but one stage, and that an early one, of a process of evolution still incomplete.

4. THE SETTLEMENT LAW OF CHARLES II. By the laws of Elizabeth the parish was made responsible practically for all who became destitute within its borders. But, as Aschrott remarks,[17] the time was not ripe for this provision, and, hence, it was the first in the law of 1601 to be altered. This alteration came in the year 1662 in what is known as the Settlement Act. This act restricted the obligation of the parish to relieve destitution to those who had a legal domicile within its borders. As title for the acquisition of a legal domicile were named birth, proprietorship of land or industry, sojourn, service, or apprenticeship. Moreover, at the complaint of the overseers, the justices might within forty days of any person's coming to live in a strange parish, order him to be removed back to his own place of settlement, unless he could give security to the new parish that he would not become a charge upon it; that is, those who had no legal settlement in a parish might be removed from it, not only in case of indigence, but also if there were a probability of their becoming indigent.

The effect of this act was practically to bind the laboring classes to the soil. First passed by the reactionary cavalier Parliament of Charles II. and re-enacted by succeeding Par-

[17] Art. *Armengesetzgebung in Grossbritannien* in *Handwörterbuch der Staatswissenschaften.*

liaments, it harked back to the efforts made after the freeing of the serfs to confine the laborer to the place of his birth. The motive of the act was, of course, to protect rich parishes from the influx of the poor from the poorer parishes. But all parishes made equally selfish use of it to hinder all migration of those without means, through vigorous exercise of the power of expulsion. The mobility of labor being thus destroyed, the growth of industry was stopped, the laboring classes impoverished by lack of employment, and the poor rates consequently increased. Thus the results of the law were disastrous to rich and poor alike. Nevertheless, subsequent legislation aggravated these conditions by making the acquisition of a new domicile still more difficult. Birth and apprenticeship were made practically the only way in which a settlement could be acquired. Not until the year 1795 did any substantial amelioration of the settlement law come about. Then expulsion from the parish was made permissible only when the person in question was actually dependent, and not then if a justice judged the person unfit to travel.

5. THE RISE OF THE WORKHOUSE. In 1691 an act was passed to secure a better administration of relief funds. It had been found that the overseers were often careless, if not partial, in their administration of the funds. It was therefore ordered that a register should be kept of the paupers in each parish, with the amount of relief given; that this list should be publicly examined at a vestry meeting once each year; that no person's name could be added to it except at that time; and that no one else should receive relief during the year except by the authority of one or more justices.[18] This exceptional clause, which was evidently designed to cover emergencies, practically placed the

[18] See Fowle, *The Poor Law*, pp. 60, 61.

supreme power in the dispensing of relief in the hands of the justices. The result was the opposite of that which was intended. The administration of relief was more lax than before, and the poor rates rapidly increased.

In consequence of the increase of expenditure from this and other causes, the idea of building poorhouses in which to care for the poor, which we have seen was commended in the law of Elizabeth, became again popular. Coupled with the idea of providing indoor maintenance only for paupers, was the notion that they could and should be put at remunerative labor in such houses. In other words, it was the workhouse rather than the poorhouse idea which began to be advocated.

The first experiment was tried at Bristol, where by special act of Parliament a workhouse was erected in 1697. The result was so satisfactory that the example was soon followed by many other places. In 1722 an act was passed which provided that parishes might, either singly or in unions of two or more, erect, buy, or rent workhouses, and ordered "that no poor who refused to be lodged and kept in such houses should be entitled to ask for parochial relief." Thus was instituted, though wholly at the option of the parishes adopting it, the "workhouse test," which was to become so famous through the reforms of a century later. The effect in the parishes where it was adopted was an immediate decrease in the amount expended for poor relief. The system was never generally adopted, however, and as it lacked central supervision it soon fell into decay.

The same act (9 George I.) which made it possible for parishes to institute the "workhouse test" also introduced the vicious system of "farming out" the poor. Parishes were authorized "to contract with any person or persons for the lodging, keeping, employing, any or all such poor in the parish."

From this farming of the poor the gravest abuses sprang up in the poorhouses and workhouses. Inhuman barbarities were perpetrated by the contractors on the helpless inmates, especially on the sick and the insane, and these were not entirely checked, though legislative restrictions were attempted, until the last remnants of the contract system were finally abolished after the reforms of 1834.

To correct these abuses and to introduce some other reforms, the important act known as Gilbert's Act was passed in 1782. This act extended the right of parishes to form unions for purposes of poor relief administration. Not only were adjacent parishes empowered to unite for the erection of a common poorhouse, or workhouse, but also for the common administration of relief. In these unions, called "Gilbert's Incorporations," the farming out of the poor was definitely abolished; and relief, both indoor and outdoor, was to be administered by paid officers, called guardians, to be appointed by the justices, while to the overseers was left merely the assessment and collection of the poor rates. The justices also were to appoint visitors who, as honorary officials, were to be associated with them in exercising supervision over the administration of relief. Unfortunately, the adoption of these reforms depended upon their acceptance by a majority vote of the different parishes. The system never became widespread, though sixty-seven such incorporations were formed, some of which in form persist down to the present day.

6. THE ALLOWANCE SYSTEM. Along with these foreshadowings of a better system, Gilbert's Act contained a menacing departure from sound principles, in that it expressly stipulated that none but the old and infirm poor, the mothers of illegitimates, and children yet unable to work, should be sent to

the poorhouse. The able-bodied poor were to be found work near their own homes by the guardians, who were to collect their wages for them and apply the same toward their maintenance, supplementing any deficiency by a grant from the relief funds.

This is the beginning of that system of wage-subsidies, or relief in aid of wages, known as the "allowance system," which for a time threatened to pauperize England's laboring classes and ruin her commercial and industrial supremacy. Its origin was undoubtedly in the humanitarian tendencies of the time; but it represented a natural reaction from the barbarities connected with the farming out of the poor in the poorhouses and the cruelties connected with the enforcement of the law of settlement. It may seem now to us a false humanitarianism which would dictate that the State find employment for those who were out of work and supplement low wages by a grant from the public funds; but to those who were then interested in the elevation of the laboring classes, the liberalization of the Poor Law seemed the natural way of accomplishing their end. They could hardly have foreseen the disaster.

The system of allowances reached its culmination in 1795 when the Berkshire magistrates inaugurated a plan of relieving, out of the poor funds, all poor and industrious families whose income was judged insufficient, the amount of the allowance to be regulated by the price of wheat and the size of the family.[19] Though never expressly sanctioned by specific legislation, the example of Berkshire was quickly followed by the whole country. The rapid spread of the Berkshire plan shows the temper of the time; but it was certainly facilitated by Parliament legalizing, the next year, outdoor relief to the able-bodied, and that in

[19] See Fowle, *The Poor Law*, pp. 65, 66.

aid of wages. The Act of 1722 which permitted parishes to establish the "workhouse test" in giving relief, was formally rescinded, and it was expressly stipulated that refusal to enter a workhouse should not be a ground for withholding relief. The only test of destitution was the opinion of the justices as to whether the income of the family was sufficient or not; and what was not earned in wages the justices usually made up in relief. The country could hardly have gone further in making the obtaining of relief easy and its administration totally indiscriminating.

Meanwhile, pauperism increased enormously and the poor rates even more rapidly. In 1783 the amount expended for poor relief was £2,004,238; in 1803 it was £4,267,965; and in 1818 it reached its maximum in the sum of £7,870,801, the population of the country being about 11,000,000.[20] The per capita taxation for poor relief in 1818 (13s. 4d.) was six times as great as it had been in 1750 (2s. 2d.). Moreover, the material condition of the poor was not bettered, for wages fell rapidly, inasmuch as the pauperized laborer depending for his support upon public relief, could afford to underbid the independent laborer. Most of all were the poor affected morally. The laboring classes, if we can believe the witnesses of the time, lost their independence, and with it their efficiency, self-respect, and self-control.

Just what proportion of the enormous increase of pauperism, which took place in England between 1780 and 1820, must be ascribed to unwise methods of relief and what to the industrial and political changes of the time, including the Napoleonic wars, it is impossible to say. But that lavish relief unwisely administered was the principal cause of this increase, was

[20] See Fowle, *The Poor Law*, p. 73.

the belief of those who, like Malthus, investigated the actual conditions at the time; and this view has never been successfully controverted. It may at least be accepted as certain that the vicious system of public relief immensely facilitated the pauperization of England's working classes at a time when their economic situation was least fortunate.

The attacks of the economists, led by Malthus, upon the system gradually aroused England to the danger of the situation and slowly prepared the way for the sweeping reform of 1834. Feeble efforts at reform were, however, made before this. In 1817 a committee was appointed by Parliament for the investigation of the Poor Laws. An able report was made; but all that came of it was the passage of the Select Vestries Act (1819). This introduced the innovation of associating with the Poor Law officers a local elective body which had the decisive voice in the administration of relief. Further facilities also were provided for the building of workhouses, and more discrimination was urged upon local authorities in the giving of relief. Such was the state of affairs when in February, 1832, a second royal commission was appointed to investigate the practical workings of the Poor Law.

7. THE POOR LAW OF 1834. The report of this commission was published in February, 1834, and contained the most startling disclosures regarding the abuses connected with the whole system of relief. Into the evidence cited by this deservedly famous document, which still merits the attention of students of poor relief, we can not enter; but it gave ample proof of an almost unbelievable state of corruption on the part of both the recipients and the givers of relief. The report had a profound influence upon Parliament, and a bill embodying

practically all its recommendations known as the "Poor Law Amendment Act," was passed by an immense majority.

The report of the commission advocated no new principles of relief. Its famous formula, "that the condition of the pauper ought to be, on the whole, less eligible than that of the independent laborer," which it declared must be the fundamental principle in a system of legal relief, was new in language only. The spirit of this principle was embodied in the Poor Law of Elizabeth, to which the report constantly refers as "the foundation and text-book of the English Poor Law." Consequently, the Law of 1834 was concerned chiefly with the organization of the administration of relief rather than with the introduction of new principles of relief.

The main provisions of the new law may be summed up conveniently under three heads: (1) A central authority was created in a board of three Poor Law Commissioners, who had extensive powers over local authorities. Not only could this board issue orders and enforce regulations as to the giving of relief, but it exercised also minute supervision over local administration through inspectors who visited the workhouses and investigated complaints, and through auditors, who audited the accounts of all local officials every half year. (2) The board of commissioners was to divide the country into districts of convenient size, to take the place of the 15,000 parishes, as the administrative units of the relief system. Each district, or Poor Law union, as it was called, had an elective board of guardians who were the responsible local authorities in the administration of relief; and as executive organs each board had one or more salaried relieving officers. (3) The guardians of each union were required to provide and build at least one workhouse, and all relief to the able-bodied outside was declared illegal, though

this provision was only gradually enforced. Thus was re-established the "workhouse test," the corner-stone of every wise system of public relief.

This résumé of the main provisions of the Poor Law Amendment Act of 1834 shows that it was essentially a centralizing measure; that, aside from the illegalizing of outdoor relief for the able-bodied, it accomplished the reform of the relief system by providing a central authority which, through supervision, could secure uniformity and efficiency in local administration.

8. LEGISLATION SINCE 1834. The board of Poor Law commissioners, established by the Law of 1834, was limited in duration to five years. From the first a bitter fight was waged upon the unlimited powers and authority of this central board, and, indeed, by the laboring classes upon the whole reformed system of relief. But the board was continued by Parliament in practically its original form until 1847, when it was transformed into a ministerial department responsible to Parliament. The desirability of consolidating various branches of local government into one department led again, in 1871, to a further change, the establishment of the Local Government Board, which has general supervision of all such matters as public sanitation, public works, and poor relief, and which has become now one of the most important departments of the Government.

The powers and functions of the central board have remained the same, save for gradual enlargement. Among these powers is that of issuing orders for the carrying out of the intentions of legislation. These orders have the force of law, and, hence, are hardly less worthy of note than acts of Parliament. Among the more important of them have been, the "Outdoor Relief Prohibitory Order" of 1844, which forbade

relief to the able-bodied outside of the workhouse, save in exceptional cases; the "General Consolidated Order" of 1847, giving exhaustive directions as to the administration of relief, the management of workhouses, the meetings of guardians, and the duties of officers; and the "Outdoor Relief Regulation Order," regulating the giving of outdoor relief in cases where permitted, especially in large cities.

Through the influence of Sir Robert Peel, in 1846, the law of settlement was further modified by what is known as the "Irremovable Poor Act." This act forbade removal in case of indigency, if the person in question had dwelt five years in the parish. Later acts reduced the period to one year of residence within the union and so increased the number of cases of "irremovability" that relief in the place of sojourn is now the rule.

In the law of 1834 each parish was to pay for the relief of its own poor, while the common expenses of the union were to be borne by the parishes in proportion to the cost of their own paupers. It soon became manifest, however, that this was a clumsy arrangement and unjust to the poorer parishes of a union. After several half-way measures the "Union Chargeability Act" was finally passed in 1865, making the Poor Law union instead of the parish the bearer of the poor rate.

For the performance of certain functions of relief, as, *e. g.*, the care of children, the Poor Law union had been found to be too small. Accordingly in 1879 power was given the central authorities to unite two or more unions for any purpose connected with poor relief. Thus many unions have been formed into districts for the erection of the so-called "District Schools" where large numbers of pauper children are educated together. The tendency is to transfer the costlier branches of public relief to these large administrative districts; and when this is not

done, subsidies from general public funds, as in the care of the indigent insane, are given local authorities for the more expensive forms of relief.

It is impossible in this brief sketch to notice the many philanthropic movements during the latter half of the Nineteenth century, which have brought about so many improvements in the administration of public relief in the case of the most helpless classes, as, *e. g.*, the agitations for the better care of the sick poor, for the removal of the insane from the workhouses, and for the better education of pauper children. These will, however, be noticed briefly in the sections which deal with the present methods of caring for these classes.

By the Local Government Act of 1894 the local administration of relief was, so to speak, completely democratized. Previous to that date the boards of guardians had been elected by a classified franchise which granted the propertied classes as high as six votes. Now equal franchise is given to all adult persons, without distinction of sex, who have resided in the union for one year or longer. As a consequence many laboring men have been elected to the boards. Women, also, can serve as guardians, and a large number have been elected. One result of this democratization of the local administration has been that in some unions there has been a large increase in the giving of outdoor relief, as the labor leaders favor greater liberality, in this respect. But this can hardly be counted a serious danger, so long as the check of a supreme central authority remains.

CHAPTER II

THE PRESENT ENGLISH SYSTEM OF PUBLIC RELIEF

Aschrott has called England "the classical land of State poor relief."[1] As we have seen, it is only in the broad sense of the word "State" that this epithet is historically deserved. Originally the relief was communal or parish relief, which perhaps may be traced back to the clan system of social organization, but which was given definite form during the Middle Ages by the fact that the Church was the sole agent of public relief. So the duty of giving relief became attached to the parish; and it remained so down to 1834. Even now the bulk of relief does not come from general public funds, raised by taxing equitably the whole country, but from local funds raised by the taxation of a comparatively small area, the Poor Law union. However, the Act of 1834 did transform the relief system from a local into a state system. It supplied what had hitherto been lacking —a central authority which could secure uniformity of administration throughout the kingdom. Accordingly, local administration has now the character of appearing derived from a central authority. The system is a state system; but the carrying out of details is left to local authorities upon grounds of expediency. The recognition of the right of relief as a civil right is further evidence of the state character of the system; but most of all does this appear in the highly centralized organization of the Poor Law administration. Let us see what this organization is:

[1]Art. *Armengesetzgebung in Grossbritannien* in *Handwörterbuch der Staatswissenschaften.*

I. THE ORGANIZATION OF POOR LAW ADMINISTRATION.[2]

(*a*) *The Central Authority.* The existing central authority in Poor Law administration is, as we have seen, the Local Government Board. The Local Government Board is composed of a president, who is the responsible cabinet minister, of a permanent and a parliamentary secretary, of several assistant secretaries, of a general inspector, and a legal adviser. In addition several other important officers of the Government are *ex officio* members. The powers of this central board over local administration, as has already been said, are of the most extensive character. These powers are exercised chiefly in four ways: through the issuing of orders, through inspection and supervision, through the auditing of accounts, and through power of dismissal.

The power to issue orders and regulations to secure the carrying out of the intentions of legislation, is among the most important functions of the central board. These orders, known as Poor Law orders, have become of greater practical importance than the Poor Law itself, since they cover the whole field of administration down even to the smallest details. Thus, after the local authorities have decided that relief shall be given and what kind of relief, the method or manner of giving the relief is rigidly prescribed. No important step can be taken by the local authorities, such as the building of a workhouse, or the formation of a new union, except it is sanctioned by a special order of the board. Moreover, the board issues, besides these orders, which are mandatory, letters of instruction and

[2] The best authorities here are Aschrott, *The English Poor Law System, Past and Present*; the article by Aschrott noted above; Fowle, *The Poor Law*; and C. S. Loch, Introduction to *Annual Charities Register and Digest*.

circulars, which are in the way of explanation and suggestion, but are of great influence.

The power to inspect and supervise local administration is another important function of the central board. For this purpose the whole country is divided into fifteen inspection districts. Each district is under one inspector, except London, which has three inspectors, making a total of seventeen. These inspectors are specialists, and usually highly educated men. Their duties are to visit the workhouses, to attend, occasionally, meetings of boards of guardians, to hear complaints, and otherwise to supervise the relief administration of their districts. Once a year they hand in a somewhat elaborate report to the central authorities.

An efficient means of control over local authorities is through the power of auditing accounts. There are thirty-seven auditors who examine, every half-year, the accounts of all officials, and who have power to disallow any item therein which is at variance with the orders of the central board. Every such disallowed item becomes a personal charge upon the board of guardians, though the Local Government Board has discretionary power to remit the disallowance.

Finally, the central board has power to discharge all officials employed by the local authorities, though these latter may neither appoint nor remove any officer without the consent of the board. This makes the administrative officers in the relief system, such as the masters of workhouses and the relieving officers, independent of local political influences, and secures efficiency by making sure the dismissal of incompetents.

(*b*) *The Local Authorities.* For the purposes of local administration, the country is divided (1901) into 656 Poor Law unions, new unions being formed from time to time as the

population increases. For each of these unions there is a board of guardians, who are the responsible local authorities charged with the carrying out of the Poor Law and the orders of the central board. The guardians are unpaid honor officers who are elected for three years from the voters of the union, one-third of their number retiring each year. The elected guardians, however, are entitled to choose, in addition, their chairman and vice-chairman, and two other members from outside their own body, provided such persons are qualified to be guardians of the union.

All persons, both men and women, are eligible, for service as guardians who are either parochial electors or have lived in the union for the twelve months preceding. Nearly every person of full age resident in the union at least one year is entitled to vote for guardians, unless he has within the previous twelve months received relief of any sort except certain forms of medical relief. The number of guardians elected in each union is fixed by the central board, but there is always one or more for each parish or city ward. In rural districts the guardians are the district councilors, but as guardians they are an administrative body separate and distinct from the district council.

The board of guardians are aided by paid officers, a clerk and one or more relieving officers. These are elected by the board, but their election must be confirmed by the Local Government Board, which also has the decisive voice regarding their salary or any later increase in salary. Moreover, as already noted, they can be dismissed only by the central authorities if guilty of any neglect of duty. The clerk keeps all records of the board, gives legal advice, and looks after many matters of detail; hence, he may have a great deal to do with shaping the policy of the board. The relieving officers receive and are

supposed to investigate all applications for relief, to report on the same to the board, and to distribute "duly and punctually" the relief granted by the board.

The boards of guardians hold regular meetings, usually fortnightly, at stated times and places. At these meetings a regular order of business, prescribed by the central board, is gone through with, including reports from the master of the workhouse and the relieving officers. For the purpose of expediting business, in the larger unions the board has numerous standing committees, such as the workhouse committee, the finance committee, and the relief committee.

2. THE RAISING OF THE FUNDS FOR RELIEF. The funds for poor relief are obtained chiefly through the poor rate. But certain subsidies from the Local Government Board, taken from the county funds, now also form no inconsiderable part of the poor funds. These subsidies are now granted for the keeping of the indigent insane in the county or borough asylums to the extent of four shillings per head weekly; also in London to the amount of five pence daily for every poor person taken care of in an institution; and finally, for the salaries and pensions of Poor Law officers. The amount of these subsidies in the year 1896-97 was £2,034,171 out of a total expenditure, for all purposes connected with the public poor relief, of £10,215,-974.[3]

Apart from these subsidies, each union must bear the expense of relieving its own poor through the local tax, known as "the poor rate." The assessment and levying of this tax is the business of the overseers, who are still appointed according to the terms of the Poor Law of Elizabeth. The overseers are

[3] See Aschrott, *Armengesetzgebung in Grossbritannien.*

unpaid honor officers, and their work is largely done by paid underofficers, known as assistant overseers and collectors.

Besides these funds, local authorities are permitted, under the approval and supervision of the central authorities, to borrow for certain purposes, such as the erection of workhouses and other institutions. The amount of these loans in the year 1896 aggregated £1,681,081.

Of the total expenditures for all purposes connected with the public poor relief for the year ended Lady Day, 1899—which were £11,286,973—£8,161,532 were obtained from the poor rate. This made the amount of the poor rate per capita of the population for that year 7s. 2 1-4d. In 1834 the amount per capita was 8s. 9 1-2d.; in 1880 it was 6s. 4d.; in 1890, 5s. 11 1-2d. Thus the amount of taxation for the relief of the poor per capita gradually decreased down to about 1890; since then it has been gradually increasing. This is due, however, largely to the better care of the indoor poor. Thus in 1885-86 the amount expended annually per capita of those relieved was £10 10 1-2d.; while in 1896-97 it had increased to £12 10s. 4 3-4d.

3. The Right to Relief and the Law of Settlement. Every fully destitute person is entitled to receive relief. The refusal of the local poor officials to relieve such a person is a punishable offense. Moreover, in extreme cases the courts would issue a mandamus to compel relief to be granted. The possibility of punishment, or of summary proceedings, however, is sufficient to prevent any neglect of duty on the part of officials. It is also to be noted that neglect to procure relief for a child, a sick or other helpless person, by a private individual who knows that such person is in need of relief, is a punishable offense.

On the other hand, persons who are possessed of money

or property, and who make false statements in applying for public relief, may be punished as idle and disorderly persons. The poor officials have, besides, a legal claim upon the present or later-acquired property of a person relieved for any relief granted within the last twelve months.

The duty of giving relief rests in the first instance upon the Poor Law union in which the poor person happens to be found. In case the person has not a legal settlement in any parish of the union he may be removed to his home, provided the removal is not excluded through special legal regulations. These cases of so-called "irremovability" are numerous. The more important of them are: (1) if the person in question has resided in the union a full year without relief; (2) if the person is a child under sixteen, living with a parent; (3) if the person is a widow during the first twelve months of her widowhood; (4) if the indigency is a result of sickness, misfortune, or accident, unless in the opinion of the justices permanent and complete incapacity for work is likely to result therefrom.[4]

In case the person has no settlement and is "removable," removal may take place, if there is no dispute, without form; but if there is dispute the guardians must secure a removal order from two justices of the peace. A pauper so removed from a union by a formal order of the justices cannot return without rendering himself liable to arrest as an idle and disorderly person. The number of removal orders issued has from year to year decreased.

A person has a settlement in a parish (1) if he has resided in it for three years "in such manner and under such circumstances as would render him irremovable;" (2) if he occupies

[4] See Introduction to *Annual Charities Register and Digest*, 1902, p. xlix.

for one year a dwelling house, whose annual rental is not less than £10, and has paid poor-rate; (3) if he owns an estate of land, however small in value, and resides in the parish forty days. Besides these "original" settlements, acquired by the person himself, there are "derivative" settlements, acquired in virtue of relationship to another person. Thus a wife on marriage acquires the settlement of her husband, and a child under sixteen takes the settlement of its father or widowed mother.[5]

It is evident from what has been said that settlement and the right to relief do not coincide. The matter of settlement is still connected with the parish while the giving of relief is the duty of the union. And relief cannot be refused if the applicant is fully destitute, and has a settlement in one of the parishes of the union or is irremovable from other causes.

4. THE PROCEDURE IN THE GRANTING OF RELIEF. Save in exceptional circumstances, all applications for relief must be made to the relieving officer of the needy person's district. The relieving officer must at once make an investigation at the house of the applicant, examining carefully into the circumstances of the case. He enters the information thus obtained in an "Application and Report Book," and at the next meeting of the board of guardians he makes a personal report upon the case. To this meeting the applicant also is regularly invited, in order that he may be given a personal hearing. After listening to the report and, perhaps, questioning the applicant, the board decides, first, concerning the granting of relief, and, if granted, then concerning the sort of relief to be given. This decision is entered in a book, the "Relief Order Book," by the clerk, and must be carried out by the relieving officer.

Over those indigent whose permanent relief is undertaken,

[5] *Ibid* p. 1.

continuous oversight is exercised by a committee of the board of guardians. Standing committees exist for several classes of the destitute, such as children, the sick, those relieved with money, and those relieved in the workhouse. These committees, usually composed of both men and women, make regular reports to the board, so that from time to time all cases are reviewed by the board.

In emergencies the relieving officer has the right to give immediate relief in kind or an order for the workhouse. At the next meeting of the board of guardians, however, he must report the case, which is then taken up in the regular way for a definite decision. The overseers and justices of the peace can also give an order for relief in any sudden or urgent necessity. This is a remnant of their old power, and is rarely used by them. Ultimately all cases must come before the board of guardians for decision.

The above description of the procedure in granting relief in any particular case represents the spirit of the law. Unfortunately it is not always possible to carry out this procedure fully. The immense amount of business which comes before some boards of guardians leads to undue haste in the disposition of cases. Thus one inspector reports that as many as eleven cases were disposed of in four minutes by one London board of guardians. Again, the duties of the relieving officer are often so heavy that he cannot give proper attention to the investigation of cases. Instead of having from one hundred to two hundred cases to look after, he often has from four to five hundred. Thus investigation is often neglected or degenerates into a mere form. Indeed, just here is one of the great weaknesses of the English system of poor relief—that it gives no adequate recognition to the value of the principle of investiga-

tion, but depends upon machinery and routine to take its place.

5. OUTDOOR RELIEF. The relief of the poor falls into two main divisions, indoor and outdoor relief. As these terms are used in England, indoor relief comprehends practically all relief given inside of institutions. It covers, in particular, the relief given in workhouses, infirmaries, schools, and asylums. Outdoor relief is relief given to the poor in their own homes; but it also includes in England the relief of the indigent insane in private asylums and licensed houses. But this exceptional use of the term is of no importance; and practically the terms indoor and outdoor relief are used to designate, respectively, relief inside and outside of the workhouse.

As we have seen, one of the most important duties of the board of guardians is to decide upon the kind of relief. For their guidance in this matter there exist the two great ordinances of the central board, already mentioned, the Outdoor Relief Prohibitory Order of 1844, and the Outdoor Relief Regulation Order of 1852. The Prohibitory Order, which holds in most districts of England, forbids the granting of outdoor relief to the able-bodied, both male and female, save under the following exceptional circumstances: (1) sudden or urgent necessity; (2) sickness, accident, bodily or mental infirmity affecting the applicant or his or her family; (3) defraying the expenses of burial; (4) in the case of a widow in the first six months of her widowhood; (5) in the case of a widow with legitimate children only, who is unable to earn her own livelihood; (6) when the head of the family is in prison or in an asylum; (7) when the head of the family is absent in the service of His Majesty, as a soldier, sailor, or marine; (8) in cases of desertion of husband when there are children resident with the

mother under seven years.[6] In exceptions (6) to (8), relief shall be given in the same manner and subject to the same conditions as to a woman in widowhood. Moreover, these exceptions apply only in the case of residents. In the case of non-residents the regulations are somewhat stricter. But outdoor relief may be given to them under practically the same circumstances as are named in exceptions (1), (2), (4), and (5) above.

Outdoor relief may also be given in many of the unions in which the Prohibitory Order is ordinarily in force under what is known as the Outdoor Labor Test Order (1842). This requires the guardians if they depart from instructions and relieve the able-bodied out of the workhouse: (1) to give half the relief in food, fuel or other articles of necessity; (2) to give no relief while the able-bodied person is employed for wages or hire; (3) to set every such pauper at work. This labor test order can only come into force in circumstances of peculiar necessity, and report must be made to the Local Government Board within fourteen days after it has been declared in force.

In London, Liverpool, Manchester, and other large cities where it seemed impossible to enforce the strict provisions of the prohibitory order because of the large number of the unemployed and the small capacity of the workhouses, the outdoor relief regulation order is permanently in force. This order permits the granting of outdoor relief to persons of the female sex without limitation; and to able-bodied male persons under the following restrictions: (1) one-half at least of the relief shall be given in food, fuel, or other articles of absolute necessity; (2) no relief shall be given in aid of wages; (3) relief is only

[6] See Introduction to *Annual Charities Register and Digest*, 1902, pp. xxxvi-xxxviii.

to be granted on condition of the performance of a task prescribed by the guardians. Further, the guardians are absolutely prohibited from using the poor funds to establish any applicant in business or trade; for the payment of rent; or for defraying traveling expenses. The exceptional cases in which outdoor relief can be granted under the prohibitory order are also valid under the regulation order, and the rules in regard to non-residents are the same in both orders.

These orders, it will be noted, neither prohibit nor regulate outdoor relief to those who are not able-bodied, such as children, the aged, and the infirm. On the other hand, they do not prevent the guardians of any union from abolishing outdoor relief if they see fit; and they especially emphasize that indoor relief is always to be preferred for the able-bodied. Any violation of these regulations, regarding the granting of outdoor relief, will at the auditing of accounts be declared illegal, and the amount, as already noted, will be charged personally to the guardians or relieving officer.

Such are the regulations under which outdoor relief must be given. The modes in which it may be given remain to be briefly noticed. It may be given either (1) in kind, or (2) in money. Relief in kind is supposed to be the safer way, and is commended by the central authorities; but relief in money is so much more easily distributed that practically all outdoor relief, which is not required to be in kind, is now given in money. The allowances are usually paid weekly at some stated time and place—a practice which is now generally condemned by the government inspectors as being degrading to the poor on account of its publicity. Outdoor relief may be given (3) in the form of employment. Under the outdoor relief regulation order the work usually furnished is breaking stone in the stone-

yard, but other sorts of work may be furnished. In most city unions, boards of guardians have the right in times of distress to open labor yards under the regulations of the outdoor labor test order. Finally, outdoor relief may be given (4) in the form of medical attendance. Each union must have at least one medical officer for every 15,000 persons, or 15,000 acres in extent. The medical officer is bound to attend any person upon receipt of an order from the guardians, a relieving officer, or an overseer. He must furnish the needed medicines and attention, but cannot order articles of food; and he must report his visits to the board of guardians, giving them such information as they may require. If a person is not already a pauper, relief through medical attendance does not legally pauperize, in the sense of entailing disfranchisement.

It was the purpose of the reformers of 1834 to put an end to outdoor relief, and especially as to the able-bodied. As regards the able-bodied, this purpose has nearly been realized. In 1849 the number of adult able-bodied paupers who received outdoor relief was still 202,265. Since then the number has steadily diminished, until in 1900 it was only 59,268. Meanwhile, the number of able-bodied adults relieved in the workhouse had only slightly increased—from 26,558 in 1849, to 34,387 in 1900, not keeping pace with the increase of population. However, the vast bulk of English pauperism still remains outdoor pauperism. In 1900, out of a total of 792,367 who received public relief, 577,122 were "outdoor paupers;" and in spite of the costliness of indoor maintenance, the amount paid for outdoor relief was still larger. But the decrease in outdoor pauperism during the half-century has been marked. Thus in 1849 the number of outdoor paupers was 955,146, or 55 in every 1,000 of the population; while in 1900 it was 577,122, or

only 18.2 in every 1,000 of the population; and, as we have seen, only a small fraction of these can in any sense be called able-bodied.[7]

6. INDOOR RELIEF. The workhouse is the fundamental institution of the English public relief system. It is such by the law of 1834 which established the "workhouse test," and such also by historical evolution: by the fact that it is the successor of the Elizabethan poorhouse; and by the fact that from it all other public relief institutions have been derived. Moreover, it is still the chief institution concerned with the indoor relief of the poor. This section will be accordingly devoted to a consideration of relief in the workhouse as practically synonymous with indoor relief. In later sections the institutions for special classes of dependents will be considered.

Each union must have at least one workhouse, which is under the control of the board of guardians. A special committee of the board exercises constant supervision over its management, visiting it as often at least as once a week. It is, in addition, visited and inspected by the inspectors of the central board and by a committee of lady visitors. Its organization and management, moreover, are regulated by the elaborate rules of the

[7] The number of outdoor and indoor paupers (exclusive of vagrants and the insane in the county or borough asylums) at different decades since 1849 is as follows:

Year	Mean No. of Indoor Paupers	Mean No. of Outdoor Paupers	Mean No. of Total Paupers	Per Cent of Estimated Population
1849	133,513	955,146	1,088,649	6.27
1860	113,507	731,126	844,633	4.29
1870	156,880	876,000	1,032,880	4.55
1880	180,817	627,213	808,030	3.18
1890	187,921	587,296	775,217	2.73
1900	215,377	577,122	792,367	2.50

Orders of the Central Board, especially of the General Consolidated Order of 1847.

Admission to the workhouse may take place in three ways: upon written order from the guardians; upon provisional order from the relieving officer; or by the master of the workhouse in cases of sudden and urgent necessity. The pauper is first taken to the receiving ward, where he is examined by the medical officer, thoroughly cleansed, and clothed in the workhouse dress. If found suffering from an infectious or contagious disease, he is placed in a special ward.

There must be at least seven distinct wards for the classification of inmates: (1) for aged and infirm men; (2) for able-bodied men above fifteen years; (3) for boys between seven and fifteen; (4) for aged and infirm women; (5) for able-bodied women above fifteen; (6) for girls between seven and fifteen; (7) for children under seven. These wards are entirely separate from one another, and between the inmates of different wards there is no communication, save that which takes place under official supervision. Children under seven, however, may be left with their mothers, and above that age parents have a right to see their children at least once a day. Further classification according to moral character is recommended in order to prevent moral contamination, but this is carried out only in the larger urban workhouses. Married couples above the age of sixty, who may wish to live together, must be provided with a separate room, should they ask for it; but it is said that this privilege is seldom claimed.

The official staff of each workhouse consists of the master and matron, the chaplain, the medical officer, and the porter. The master is responsible for the whole administration of the workhouse, and has, accordingly, a great deal of power. The

matron, who is usually his wife, assists him in the supervision of the female wards. It is the master's duty to look after the classification of the inmates, their employment, and their food. He must enforce order, industry and cleanliness. He must visit the wards twice daily. He must see to it that the daily routine as regards meals, hours of rising and retiring, is observed by all; and, in a word, that none of the numerous rules established by the central authority for the guidance of inmates and officials are violated.

A special chaplain is appointed for every workhouse. His duties are to hold services for the inmates every Sunday, to give religious instruction to the children who belong to the Church of England, to visit the sick, and to minister to the dying. The ministers of other denominations, however, have free access to the workhouse to visit inmates of their own denomination.

The medical officer has to attend to the sick, to see that their diet and that of the children is suitable, to report to the guardians concerning sanitary conditions, and to examine the newly admitted.

The porter keeps the gate and allows no one to go in or out without leave. It is also his duty to prevent intoxicants and other forbidden articles from being brought into the workhouse.

From this brief description of the duties of the officers it will be seen that the regime of the workhouse is more like that of a prison than of a home. Indeed, the distinctive feature of workhouse administration is supposed to be the compulsion to labor. The central authorities have taken strong ground against the conversion of the workhouse into an almshouse, and have insisted that work of some sort be furnished for all who are able to work, and that no one who can work be allowed to be idle.

No remuneration is to be given for this work, and its character is determined by the local board of guardians. However, on account of the rigor with which this labor test has been applied, more and more the workhouse population has come to be made up of the aged and infirm, and other helpless elements, who are capable of performing little or no labor. Thus the workhouse has come, in spite of the law, to be practically an infirmary or almshouse, though its discipline remains a sufficient deterrent to accepting its relief.

The life of the inmates is monotonous if not severe. They rise at a fixed hour, respond to roll-call, meet for meals, go to work, leave off work, and go to bed, all according to a fixed schedule. Their fare is of the plainest, being, it is supposed, no better than that of the lowest class of independent laborers. The aged and infirm, however, have a slightly more generous diet, while that of the sick and of the younger children is regulated by the house physician. Intoxicating drinks are strictly forbidden, and so, also, are smoking and games of chance. Food may not be brought to the inmates by friends from outside, and all books and papers brought in are strictly censored. The guardians, however, are supposed to supply books and newspapers. Friends of inmates may visit them in the workhouse at any time by permission of the master, and there is generally a fixed day for visitors once a week.

To maintain discipline there is a system of penalties for the violation of rules. The punishment consists in a reduction of food for periods of less than forty-eight hours. Not less than thirteen offenses are so punishable. If the offense is repeated, or is one of eight grave offenses, there may be solitary confinement and reduction of diet up to twenty-four hours.

Corporal punishment is not allowed, save in the case of boys under fifteen years.

If an inmate wishes to leave the workhouse, he must be allowed to do so after he has given reasonable notice of his intention. The notice required is usually one of twenty-four hours, but if he has discharged himself previously during the month he may be detained forty-eight hours; and if he has discharged himself frequently without sufficient reason, he may be detained a full week. When a pauper leaves the workhouse, he must take all his family with him, unless some of them are sick or detained by the authorities for special reasons.

Such is the English workhouse system of the present. Certain tendencies are, however, slowly modifying it, and these require to be noted from their inception in order that the present situation and probable developments may be clearly grasped. After the reform of 1834, all indoor relief was concentrated in the workhouse. But in spite of system and classification it soon became evident that certain classes of dependents could not be properly cared for in the workhouse. The children were the first to be partially removed. Already, in 1844, separate schools were authorized for the education of pauper children. But even yet, as we have seen, a large number of children remain in the workhouses; and in spite of the admirable arrangements made for them in the workhouses, there is a growing number of philanthropic workers who think that all children should be removed from the workhouse. Again there was early an agitation for the removal of the sick poor and the indigent insane from the workhouses. This resulted in the establishment of county and borough asylums for the insane, and in the cities of large infirmaries for the care of sick paupers. However, there still remains a considerable number of the harmless insane in

the workhouses, while in country unions the only provision yet for the sick is a separate sick ward in the workhouse. Again, the perception has gradually grown upon the authorities that the semi-criminal class, known as "tramps" or "vagrants," could not be properly dealt with in an ordinary workhouse. Hence, in the workhouses in towns there have been established so-called "casual wards" for vagrants, entirely separate from the rest of the workhouse, and sometimes these are separate institutions. Finally, the difficulties of furnishing occupation for all of the workhouse inmates has led to a still further differentiation. In several instances two or more unions have united to erect a common special institution for the able-bodied, where a vigorous compulsion to work can be enforced; while there has been a tendency at the same time to furnish recently erected workhouses with a certain grade of comfort which gives them more the appearance of homes for the aged and infirm.[8]

It is evident, then, that changes are now going on which will soon alter the present organization of the workhouse, and that we must therefore, regard it as an institution whose development is still incomplete. The future development will be sufficiently evident when we have considered the specialized institutions which already exist for the care of special classes of dependents.

7. THE TREATMENT OF VAGRANTS.[9] As we have already noted, there are now "casual wards" connected with nearly all workhouses for the relief of so-called "casual paupers," or vagrants. These are usually merely separate departments of

[8] Aschrott, *Armengesetzgebung in Grossbritannien.*

[9] Under this head see besides the *Annual Charities Register and Digest* the U. S. Consular Report on *Vagrancy and Public Charities in Foreign Countries* (1893).

the workhouses, but in London and other large cities they are often distinct institutions with superintendents of their own. Casual wards are of two types, open or "associated," and "separate." The former are merely large rooms with plank beds, the only separation being that of the sexes. In the latter there are separate cells or compartments for each individual, both for sleeping and for the performance of work. Thus, under this system there can be no communication between vagrants, and, hence, no moral contamination, as there can be in the "associated" wards. Wards constructed on the "associated" plan, however, are much more common than those on the "separate" plan. Casual wards are inspected regularly by the inspectors of the Local Government Board, and are of course under the control of the board of guardians of the union in which they are situated.

Admission to the casual ward is usually by an order from a relieving officer, which is good only for the night issued. But the master of the workhouse or the superintendent of the ward may admit, without order, cases of urgent necessity. Usually cases which are brought by a constable or a policeman are received. The wards are open for admission from October to March, inclusive, after 6 p. m.; and from April to September after 8 p. m.

On admission the vagrant is searched, bathed, and dressed in clean clothing, while his own is disinfected. If money is found on him it may be retained for his lodging. He is given a supper and breakfast of bread and gruel. Work is given him the morning after his admission, which usually consists of breaking stone or picking oakum. There is a definite task for each night or day of detention, and this the vagrant must perform before he can leave. For disorderly or refractory conduct

the master of the workhouse can take the vagrant, without a warrant, before a magistrate who can send him to jail for one month at hard labor.

The vagrant is not allowed to discharge himself before nine o'clock in the morning of the second day following his admission. But discretion is allowed the guardians in the application of this rule, and if there are special circumstances justifying it the vagrant is discharged the day following his admission, provided he has performed the prescribed work. If the vagrant, however, has already been admitted to the vagrant ward once before during the month, he is not entitled to discharge himself before 9 a. m. on the fourth day after his admission.

Besides relief in the workhouse or casual ward, the vagrant may, as we have seen, receive outdoor relief from the relieving officer in cases of sickness, accident, or other "sudden or urgent necessity." But relief in such cases must not be in money. In cases of sickness or accident the vagrant may, of course, be taken to the infirmary, the expense being borne by the union in which he happens to be, subject to reimbursement from the union in which he belongs.

To overcome the evils of indiscriminate private relief to this class, the guardians in one or two counties have adopted the plan of distributing bread-tickets among the residents of the county. These tickets when given to the vagrant in lieu of alms are exchangeable for bread at certain shops, so that the giver may feel that there is no danger of starvation. No matter how many tickets the vagrant may have in his possession, he can only be supplied with a fixed amount of bread in return for them. The object of this system is to discourage private relief to vagrants, in order that they may be dealt with more effectively by the public authorities. However, it is only par-

tially successful in preventing the giving of alms to this class.

The numerous attempts to deal with the vagrant class through private charity, such as that of the Salvation Army, will be noticed later. It remains here only to note the repressive features of the criminal law for the correction and punishment of this class. If any person is found begging or soliciting alms in the streets or at houses, he can be convicted as an "idle and disorderly person" and sentenced to hard labor for not longer than one month. If, after having been convicted once, he is again caught begging, he may be sentenced to hard labor for not more than three months as a "rogue and vagabond." A third conviction brings committal to a house of correction and imprisonment with hard labor for not more than one year as an "incorrigible rogue and vagabond."

The number of vagrants in England seems to be increasing, if one may judge from the number relieved in the workhouses and casual wards in different years since 1860. In 1860 the average nightly number relieved was 1,905; in 1880 it was 6,709; in 1890, 4,929; and in 1900, 9,400. This increase, however, is probably in part apparent rather than real, and is not greatly out of proportion to the increase of population.

8. THE CARE OF THE SICK.[10] Up to 1867 the only provision for the public care of the sick poor was the sick wards of the workhouses. In that year the Metropolitan Poor Act authorized the establishment of sick asylums and infirmaries in London for the reception of the sick poor. Since then the system of separate infirmaries for the care of the destitute sick has spread to nearly all urban unions; but in the country unions the sick wards of the workhouses are still the only public provision for the sick.

[10] See *Annual Charities Register and Digest*, Introduction.

The Poor Law infirmaries are equipped like ordinary hospitals. In construction and in skill of medical staff they are not inferior to the best private institutions. Moreover, the poor do not look upon it as a disgrace to enter the infirmary, as they do to enter the workhouse, since the care received is the best and the acceptance of such relief does not disenfranchise. In consequence, the infirmaries are one of the most popular features of the Poor Law system and are well patronized. In London alone there are twenty-eight of these institutions, with an average daily number treated (1899) of over 12,000. In addition to the infirmaries, there are maintained out of the poor funds in several of the large cities, hospitals for various kinds of contagious diseases, such as fever and smallpox.

Admission to an infirmary or other Poor Law hospital is on the same general conditions as to the workhouse, plus the requisites for admission to such a hospital. The medical superintendent, however, has the right to admit any person who presents himself, if he sees fit. The guardians may recover the amount incurred by the treatment of any person not destitute.

The infirmary is directly in charge of a medical superintendent, and under the general control of the board of guardians of the union. However, in London there is a Metropolitan Asylums Board which has general charge of the indoor accommodations for the sick poor, and so has the supervision of all Poor Law hospitals in the metropolis.

The infirmaries may be used as training schools for nurses. This is now the more necessary on account of an order of the central board in 1897 which forbade the employment of pauper nurses in sick wards and infirmaries. There is consequently a great demand for nurses in rural workhouses and great difficulty in obtaining a sufficient supply. While the standards of

nursing in the London infirmaries have long been those of the best private hospitals, the nursing in provincial workhouses and infirmaries has until recently been on a lower plane. But, through the strict regulations of the Local Government Board, the conditions are now being rapidly improved.

In case there is not sufficient accommodation for the sick in any Poor Law union, the guardians may, with the consent of the Local Government Board, pay annual subscriptions toward the support of any hospital for the reception of the sick poor of the union. In a similar way they may also subscribe towards any association for providing nurses.

The outdoor medical relief of the poor has already been described under the heading of Outdoor Relief. But in addition to the provisions described, there are in London and other large cities Poor Law dispensaries under the control of the guardians. Medical relief is given at these upon order from the relieving officers or the guardians. Drugs, medicines, and medical appliances are supplied, and some of the medical officers of the union are in daily attendance except Sundays.

There remains only to notice the public provision for vaccination connected with the relief system. This is in the way of prevention of sickness, rather than of relief, but it is nevertheless a phase of medical relief. Unions or parishes are divided into vaccination districts. These are in charge of vaccination officers, and in each district there is a public vaccinator appointed and paid by the guardians. Every child who is not unfit for it, or whose parents do not conscientiously object, must be vaccinated within six months after the registration of its birth. Vaccination is free and is not considered parochial relief.

9. THE CARE OF DEFECTIVES.[11]

(1) *The Blind.* As the blind are classed among the not-able-bodied, the guardians can give outdoor relief to them irrespective of age. Moreover, relief may be given to a blind wife or to blind children without thereby rendering the husband or father legally a pauper. Indoor relief for the blind is, of course, provided by the workhouse; but in addition the guardians may provide for the reception, maintenance, and instruction of any adult blind pauper in a hospital or any institution established for the care of the blind.

For the instruction of blind children, guardians are empowered to send a child to any certified school for the instruction of the blind, and to pay the reasonable expenses of such child whilst in such school, to an amount not exceeding six shillings weekly. Further, the guardians may, with the approval of the Local Government Board, send any poor blind child to any school fitted for its reception, though it is not a certified school. But these provisions of the Poor Law have been practically superseded by the Elementary Education Act of 1893.

That act provided for the compulsory education of all blind and deaf children between the ages of seven and sixteen. It is obligatory on the parent of a blind or deaf child to cause it to attend school between those ages. School authorities must, on the other hand, provide suitable schools for such children, or contribute to a certified private school for the education of such children. The expenses of and incidental to the attendance of such children at school must be borne by the school authorities; but the parent is liable to contribute such weekly sum as he is able; and if the amount cannot be agreed upon, it is to be

[11] See *Annual Charities Register and Digest*, Introduction.

decided by a court of summary jurisdiction and collected as a civil debt.

(2) *Deaf-mutes.* The public provisions for the relief and instruction of deaf-mutes are almost exactly the same as those for the blind. The guardians may relieve them either outside or inside of the workhouse, or may provide for their maintenance in some private institution. Deaf and dumb pauper children may be sent by the guardians to a school suitable for their instruction, just as blind children. But their education is now, as we have just seen, provided for in the elementary school system of the country; and their maintenance is included in their education, unless their parents are able to contribute.

(3) *The Feeble-Minded, Imbeciles, and Idiots.* The term "feeble-minded" is not used in England in a generic sense including all the mentally defective from the dull child down to the low grade idiot. It is rather used to designate those who are only slightly mentally defective—who cannot be taught by ordinary methods. Provision for this class of defectives has only recently been made in the English educational system, and is still very inadequate. A movement for special schools for these children was first started in London about 1890. Since then thirty-two schools for the special instruction of defective children have been opened in different parts of London, and these had in 1901 an average attendance of 884 children.

By the Elementary Education Act for Defective Children (1899), very similar provision has now been made for defective and epileptic children to that for the blind and the deaf. Children who are not imbecile, but incapable, by reason of mental or physical defect, of receiving proper benefit from the instruction in ordinary public elementary schools, and epileptic children, must attend some certified special school between the ages

of seven and sixteen. School authorities may make provision for the education of such defective children by the establishment of special classes, or schools, or by contributing towards the establishment or maintenance of some certified (private) school. Further expenditures may be incurred by the school authorities as in the act for the education of blind and deaf children.

There is a National Association for promoting the welfare of the feeble-minded, which works in co-operation with the public authorities. The association has three homes, and to these Poor Law authorities can commit feeble-minded children. Poor Law authorities also have the same powers in dealing with feeble-minded children as in the case of blind and deaf children.

The public provisions for the care of the imbecile and idiot classes in England are extremely deficient. In the whole of England there were in 1901 but eight institutions exclusively devoted to their care or education, though there were a number of county asylums with special wards or annexes for their accommodation. It follows that the vast majority of England's idiot and imbecile class are still in the workhouses, or with friends or relatives.

The guardians have large permissive powers with respect to this class. They may send idiotic persons to certified schools, and, with the consent of the Local Government Board, to any asylum or establishment for their reception and relief. They may also provide for the education of idiotic or imbecile children in the same manner as blind or deaf children. But the permissive character of these laws, as well as of the Lunacy Act of 1890, which empowers local authorities to provide separate institutions for idiots, renders them almost inoperative.

In London the provisions for this class of defectives is better than elsewhere. The Metropolitan Asylums Board provides

accommodation in its Darenth Schools and at Ealing for more than 1,000 imbecile children. The Darenth Asylum also has custodial care of nearly as many adults; and at Leavesden and Caterham there are asylums for adult idiots and imbeciles and for harmless lunatics under the same board. The Darenth Asylum is the only institution for idiots in England wholly supported from the poor rates. The other seven are largely supported by charitable contributions and payments for inmates, nearly all of them expressly refusing to receive pauper cases.

(4) *Epileptics.* No public provision has yet been made in England for the care of epileptics save that contained in the Elementary Education Act for Defective and Epileptic Children of 1899, which we have already noticed. By this act the school authorities, as we saw, are empowered to provide for the education and maintenance of epileptic children by means of certified homes, either under their own or under voluntary management. Adult epileptics, if sane, who are unable to care for themselves, are left either in the workhouses, or with friends, or to private charity. A census of the workhouses of England showed that on January 1, 1900, there were in them 2,566 sane epileptics.

There are, however, three or four important institutions of a semi-public character for the care of epileptics. The chief of these is the Chalfont Colony established by the National Society for the Employment of Epileptics. The colony is organized on the German plan. The society is carrying on the work of establishing such colonies and homes for epileptics, and is agitating for State action in the matter.

(5) *The Insane.* There were, on January 1, 1900, a total of 96,865 insane paupers in England. Of these 17,460 were in workhouses; 5,847 were in receipt of outdoor relief (being boarded or with relatives); 70,833 were in the county or borough

asylums; 1,243 were in registered hospitals or licensed houses (private asylums); and 1,482 in unlicensed houses.

These different modes of caring for the insane demand a word of explanation. The county or borough asylums, which contain the largest number of the pauper insane, are supported mainly from county funds and are under the local control of visiting committees of the county or town councils. By the Local Government Act of 1888 a payment of four shillings per week is to be made from the county revenue for each inmate of these asylums when the cost of maintenance per inmate is equal to or exceeds that sum. The difference over and above the four shillings is made good from the poor rates of the Poor Law unions from which the inmates come. Thus the unions are without motive for keeping their insane paupers in the workhouses, since the cost of their care in the county asylums is almost wholly met from county revenues.

Nevertheless, as we saw, there are still about 17,000 insane paupers in the workhouses. This is due to the fact that many chronic lunatics who are harmless are discharged from the asylums to the workhouses. But this can only be done by consent of the Local Government Board, and a medical officer must certify in writing that the insane person in question is a proper person to be allowed to remain in the workhouse. It must not be supposed that the condition of the insane in English workhouses is in any way comparable to the condition of the insane in American almshouses. Their presence in the workhouses is safeguarded by the central authorities of the Government in every way. Yet it is generally admitted that it is undesirable that any insane should be kept in the workhouses, and there is considerable agitation for their complete removal.

A number of the harmless insane are boarded with friends

or relatives under the supervision of the guardians. Unlicensed houses are allowed to care for only one patient. Licensed houses may care for several and are inspected frequently. They are simply small private asylums, carried on for private profit. Registered hospitals differ from licensed houses in that they rest on charitable endowments. To all of these, guardians may commit insane paupers with the consent of the central authorities.

Over all the public and private institutions for the care of the insane are the Lunacy Commissioners. These constitute a supervisory board with extensive powers. They consist of a chairman, one unpaid commissioner, and six paid commissioners, of whom three are legal and three medical. Each county asylum is inspected annually by two or more commissioners; each licensed house six times a year; each registered hospital once a year. The commissioners also visit workhouses in which there are insane, and inspect all unlicensed houses at least once each year.

Commitment of the insane to institutions takes place through "reception orders" issued by a justice of the peace or other judicial authority. A petition for a "reception order" must be accompanied by two medical certificates from different practitioners to the effect that the person is insane. In some cases, especially where property is involved, the inquiry may take place before a jury. If the judicial authority is satisfied that the facts are as alleged, he issues the reception order, and the relieving officer accompanies the lunatic to the asylum.

After-Care Associations exist to aid poor patients who are discharged recovered from the asylums to start again in life. The associations provide cottage homes in the country for convalescent purposes, find employment for the recovered insane

and assist them by grants of money and clothing. In this way much is done to prevent relapses.

(6) *Inebriates.* Until recent years habitual drunkenness was considered merely as an offense calling for punitive treatment. But in England as elsewhere the tendency now is to consider it a malady nearly allied to insanity and calling for remedial treatment in special hospitals and sanatoria. By the Inebriates Act of 1898 State interference and control in certain cases of habitual drunkenness are provided for. A person who is convicted of an offense punishable with imprisonment and who is an habitual drunkard, if the court is satisfied that the offense was committed while under the influence of drink, or that drunkenness was a contributing cause, may be sent to a State inebriate reformatory or to a certified (private) inebriate reformatory for a term not exceeding four years. Again, any person who has been convicted of drunkenness three times during twelve months, and who is an habitual drunkard, may upon a fourth conviction be sent to an inebriate reformatory to be detained not longer than three years.

This act, however, has not been put into operation widely for the reason that there are comparatively few inebriate reformatories. The act provides for the establishment of such reformatories either by the Secretary of State from moneys provided by Parliament, or by county or borough councils from county funds supplemented by grants from the treasury. Counties may also contract with private reformatories to receive criminal inebriates, if such reformatories have been certified by the Secretary of State as fit for the purpose. By the end of 1901 eighteen counties and seventy-eight county and municipal boroughs had made some provision for drunkards convicted in accordance with the terms of the act.

Under the Habitual Drunkards Act (1879) a system of licensed "retreats" exists for the voluntary reception and detention of habitual drunkards. A borough or county council can give a license to keep such a retreat for a period of two years. A competent medical man must be attached to each retreat, and they are inspected twice each year by a government inspector of retreats. Any habitual drunkard may apply to the keeper of the retreat for admission if he is willing to sign a statement that he will submit to the regulations and remain in the retreat a certain time. Two persons must also make a declaration that the applicant is an habitual drunkard and understands the effect of his application; and finally, a justice of the peace has to attest the applicant's signature on the same two conditions. The applicant once admitted cannot leave the retreat until the expiration of the period fixed upon for his detention, unless discharged by the order of a justice. He cannot be detained longer than two years; but he can be readmitted at any time upon his own application, and thus in effect the term of his detention extended.

There are about twenty of these "licensed retreats" having accommodation for about 250 patients, and nearly as many more not licensed, having provision for about the same number. On the whole, the stage of development of these institutions, as well as of the inebriate reformatories, must be considered far from satisfactory. There is no compulsory detention in retreats other than that agreed to by the applicant and no provision at public cost for the treatment of poor inebriates, or those of limited resources. Moreover, those retreats and homes which have admitted, upon contract with counties or boroughs, cases committed by the courts have been seriously demoralized, as often these cases on account of their moral depravity have been found unsuited for treatment in such private institutions.

(7) *Cripples.* As we have already seen, there is the same provision under the Elementary Education Act of 1899 for lame or deformed children, who, by reason of their physical defect are incapable of receiving proper benefit from instruction in the ordinary public elementary schools, as there is for defective and epileptic children. In addition, the guardians have the power of sending such children either to certified schools or to any asylum or institution where they may be permanently cared for, the expense being borne by the Poor Law union. There are now about a half-dozen such homes or schools for cripples, under different auspices, where they receive industrial training. Besides these, there are a number of orthopedic hospitals where the diseases and malformations of cripples are treated by surgical means. But on the whole it must be said that the special provisions for this class of unfortunates in England, as in other countries, are still extremely meager and manifestly insufficient. The bulk of this class in adult life seem to be found in the workhouses or in private homes for incurables.

10. THE TREATMENT OF CHILDREN.[12] The law of 1834 left the children in the workhouses, but even at that early time there were not wanting those who protested against such an arrangement. Accordingly in 1839 the Poor Law commissioners instituted an inquiry into the condition of the children in the workhouses, which resulted in a report in 1841 recommending that unions be combined into districts for the establishment of schools for pauper children. Three years later a law was passed authorizing the establishment of these so-called "District Schools." Since then the agitation for the complete

[12] Under this head see Chance's *Children Under the Poor Law*, Aschrott's *English Poor Law System*, and *The Annual Charities Register and Digest*, Introduction.

removal of the children from the workhouses has continued, and various methods have been placed at the option of boards of guardians to bring this about. But in 1890 there were still 53,815 children under fourteen years of age receiving indoor relief, the majority of whom were in workhouses. Nevertheless, the educational standpoint is now dominant in the treatment of pauper children, though there are still those who oppose every measure which seems to make the condition of dependent children better than that of the children of the lowest independent laborer, forgetting that this principle is wholly negative and repressive and that in the treatment of children the curative side of the Poor Law should manifest itself.

There are now at least seven different ways in which Poor Law authorities may care for dependent children, besides the ordinary method of granting outdoor relief:

(1) They may keep the children in separate wards in the workhouse, providing a school for them within its walls. This system is still common in the rural workhouses, though the number of unions which practice it is steadily decreasing, as the Local Government Board does not encourage such workhouse schools. However, in 1900 there were still in such workhouse schools 2,836 children.

(2) Guardians may keep children in the workhouse, but send them to an ordinary public elementary school. This system is now in general vogue; no less than 508 out of 649 unions in 1900 sent children to the public elementary schools. While this system is some improvement upon the workhouse school, it is to be condemned as in no effectual way removing the children from the moral contamination and degradation of workhouse life.

(3) Children may be sent to what are called "Poor Law

Schools," of which there are several kinds. First of all may be mentioned the "District Schools," provided by two or more unions according to the Act of 1844. These district schools are usually associated with large urban unions, such as those of London. They are generally institutions of considerable size, accommodating from 300 to 1,000 pupils. Their size and the barrack-like plan upon which they were formerly constructed have occasioned much criticism of these schools in recent years. It is justly claimed that large numbers of children cannot be cared for under such conditions without serious danger to their physical and moral health. To meet this criticism the latest of these schools have been constructed upon what is called the cottage-home system. A village of cottages is built around a school, a chapel, a hospital, and other buildings. Each cottage provides accommodation for not more than thirty children and a foster father and mother who are supposed to make something like a real home for the children. The schools built upon this cottage plan have been highly successful, and this system of caring for pauper children is, perhaps, most in favor with the central authorities at the present time; but the costliness of construction and administration in this system precludes its general adoption.

Another form of Poor Law school is the training ship. Ships for training boys for sea service may be provided by boards of guardians or the boards of school or asylum districts, and are under the same general regulations as other Poor Law schools. At present the only such training ship provided is the "Exmouth" under the control of the Metropolitan Asylums Board.

The most common form of Poor Law school are the so-called "Separate Schools." These are provided by single

unions, and are known as separate schools because they are built outside of the workhouse walls, and usually at some distance from the workhouse. The children live in them, usually in large dormitories, and in all respects they are essentially like the district schools, only smaller. They are under the management of a special committee of the board of guardians of the unions to which they belong. In 1900 there were 10,300 children in these separate schools, as against 6,690 in the district schools and 2,836 in the workhouse schools. This made a total of 19,826 children in the Poor Law schools while in 1883 there were 35,335.

The instruction given in the Poor Law schools is of the highest grade. They are under periodic inspection by inspectors appointed by the Local Government Board; and to encourage the employment of competent teachers Parliamentary grants are made according to the grades of the teachers' certificates. The instruction is mainly of an industrial character.

(4) A fourth means which the guardians have of educating pauper children is by sending them till the age of fourteen to certified schools under private management. These are mainly ecclesiastical schools or homes, many of them under the control of the Roman Catholic Church. They must be certified by the Local Government Board as fit to receive pauper children and they are inspected from time to time by the Poor Law inspectors. The guardians cannot pay for the maintenance and tuition of a child in such a school more than what would have been the cost of its support in the workhouse during the same period, and in any case not more than six shillings weekly. Many of these schools are for children with some physical or mental defect, such as the blind, and the deaf and dumb. No child can be sent to a school conducted on the principles of a

religious denomination to which its parents did not belong, or if they be alive, without their consent.

(5) A new plan of caring for pauper children is through what are known as "Scattered Homes." Houses are built or hired by the guardians in various parts of a town or union at convenient distances from the public elementary schools, and in each of them about ten children are lodged under the care of foster parents. Thus far only a few unions have tried this plan, and as yet it must be considered as only in the experimental stage.

(6) Another means which the guardians have of caring for dependent children is boarding them out, either within or without the union. This is regulated by a special Poor Law Order of 1889. Unions which board out children beyond their own limits must have a boarding-out committee consisting of three or more members who are responsible for finding and superintending the homes at which the children are boarded; but unions which place children only in homes within their own limits may do so without a committee, in which case the duty of looking after the children falls upon the relieving officer and the medical officer of the union. The children who may be boarded out must be orphans or deserted, and between the ages of two and ten, except that a child above ten may be placed in the same home with a younger brother or sister. Before a child can be placed in any family it must be furnished with a certificate of health by the medical officer of the union. Except in case of brothers and sisters, not more than two children can be boarded in the same house, and never more than four. The foster parents have to undertake to bring up the children as their own and to see that they attend school and church. There must be a school within a mile and a half of the home, and the residence

of a member of the committee must be within five miles. When once placed, a child remains with its foster parents until the age of fifteen, unless the guardians withdraw the child, which they may do at any time upon one week's notice. Every six weeks the child must be visited by a member of the committee and its moral and bodily condition reported to the board of guardians. In addition children who are boarded outside of the union are inspected from time to time by women inspectors of the Local Government Board. The compensation to the foster parents may not exceed four shillings weekly for each child, exclusive of small allowances for clothing, school, and medical fees.

There are still other regulations and restrictions, only a few of which can be mentioned. Thus the child cannot be placed with relatives, or with persons who have recently received public relief. Again, in placing children, preference is to be given to the families of laboring men, and they are not to be sent to homes in places having a population of more than 15,000.

The boarding-out system has the obvious advantage over any form of institutional care, that it furnishes a natural instead of a more or less artificial life for the child. It makes possible that individual care and those personal attachments without which the normal development of the child cannot take place. Moreover, it effectually removes it from the atmosphere of pauperism and puts it into a normal relation with its social environment. Nevertheless, the boarding-out system has many opponents. This is partly due to bad management. Unless there is strict supervision by both local and central authorities, the boarding-out system is liable to develop serious evils. Again, others oppose the system for purely abstract reasons, such as, that it puts the child of the pauper in a better position than the child of the independent laborer. Owing to this opposition the board-

ing-out system has made but little progress in England since its introduction from Scotland about 1870. In 1900 there were 7,358 children boarded out, of whom 5,448 were boarded out within the unions to which they belonged, and 1,910 were boarded out outside of the union.

There is no attempt in England to place children in families with a view to their later adoption, according to the American plan. The law does provide, however, for the adoption of dependent children. They must be visited during a period of three years after their adoption, by the guardians, twice each year; and the guardians may at any time during this period revoke their consent to adoption if they think fit.

Here may be noted the plan of procuring the emigration of orphan or deserted children to the colonies, where suitable homes are supposed to be found for them. Orphan or deserted children under sixteen may, with their own consent and the consent of the Local Government Board, be sent to Canada under the following conditions: They must be entrusted to a responsible party, who, after placing them, must report the name and age of each child and the name and address of the person with whom the child is placed, to the Department of Agriculture at Ottawa, to the guardians of the union from which the child is taken, and to the Local Government Board. Protestant children must be placed with Protestant families and Catholic children with Catholic families; before emigration the children must have had a certain amount of schooling and receive a health certificate from the medical officer. The emigration of girls above the age of twelve is strongly disapproved by the Local Government Board. The number of children assisted to emigrate from year to year by the Poor Law authorities is comparatively small, not more than two hundred a year.

(7) One other method of dealing with pauper children remains to be noticed: the guardians may apprentice or send them out to service. This method is now reserved for dealing with older children, the law providing that any poor child above the age of nine years who can read and write his own name may be apprenticed out. Apprenticeship is considered a sort of relief, though neither parent nor child need be in receipt of other relief at the time. The term of apprenticeship cannot be for more than eight years. The consent of the person to be apprenticed, if under fourteen years of age, must be obtained; and the consent of parent or guardian, if the child is under sixteen, is usually required. The person to whom the child is apprenticed must be a "housekeeper or assessed to the poor-rate in his own name." If the child is under sixteen the guardians must pay a premium partly in money and partly in clothing. In return the master has to teach the trade or business agreed upon, to the child, and has to provide proper food, lodging, and clothing, and in case of sickness or accident, medical assistance; he must arrange for suitable religious instruction being given according to the creed of the apprentice; and finally, after the age of seventeen, the apprentice must be paid such wages as the guardians may stipulate. If the terms of the indenture are transgressed, it is cancelled.

In a similar manner boys may be apprenticed to masters or owners of ships for service at sea. Guardians may also pay the expenses of boys, whose parents are in receipt of relief, to the nearest port to be examined for entrance into His Majesty's naval service.

Guardians must cause all apprentices under sixteen to be visited twice a year by a relieving officer or other suitable person, who reports to them upon the condition, treatment, and conduct of the children.

The Guardianship of Dependent Children. The guardians may at any time by resolution assume control over a child who is wholly or partly maintained out of the poor rates and (1) who is deserted by its parents; (2) whose parents, in their opinion, are unfit to have control of it by reason of vicious habits, or mental deficiency; (3) whose parents are unable to perform their parental duties by reason of imprisonment or being permanently disabled; (4) both of whose parents are dead. By an Act of 1899 the control of the guardians over such a child lasts until the age of eighteen, and it is safeguarded by severe penalties for interference with the child over whom control has been assumed. Moreover, if a child has been deserted or abandoned by its parents, or allowed to be brought up at the expense of another person or a private institution, the court may, at its discretion, refuse custody of a child to such parent, if he be judged an unfit person for the custody of his child, and grant the custody of the child to such private person or institution.

Morally Imperiled Children. For morally imperiled children there are four classes of schools—the Reformatory Schools, the Industrial Schools, the Truant Schools, and the Day Industrial Schools. The first two rest upon voluntary foundations and are under private management, though they receive public moneys in payment for children committed to them by the courts and are subject to inspection by government inspectors. The truant schools and the day industrial schools, on the other hand, are under the control of school boards and so are maintained directly out of public funds. They are a somewhat recent experiment and are confined to large urban centers. The functions of these four different classes of schools we will consider in the order named.

(1) The reformatory schools are for children with distinctly criminal tendencies under sixteen years of age who have been convicted in a regular manner of an offense punishable by penal servitude or imprisonment. Children under twelve are rarely sent to these schools unless they have been previously convicted. The commitment is for a period of from two to five years, or the court may make an indefinite commitment, lasting not less than three years nor longer than the age of nineteen. Imprisonment in a jail or local prison previous to reception in a reformatory school was by an Act of 1899 abolished. As these schools may be regarded as strictly a part of the English penal system, they will not be further considered here, except to say that in management and organization they are similar to the industrial schools.

(2) The industrial schools are for morally neglected and incorrigible children under fourteen years of age, and also for children under twelve with criminal tendencies who have not been previously convicted of felony. As was said above, these schools were originally established by voluntary agencies, mainly by religious denominations, but they now derive their support almost wholly from grants made by the treasury, school boards, and county councils. They must be certified by the Local Government Board as fit for the reception and training of morally neglected and refractory children, and they are inspected periodically by a government inspector of reformatory and industrial schools. In 1900 the number of industrial schools was 142, and they had under detention 24,718 children.

Children may be committed by a magistrate to an industrial school (1) if found begging or receiving alms; (2) if found wandering without home or visible means of subsistence; (3)

if destitute, being either orphans or having parents in prison; (4) if found frequenting the company of reputed thieves or reputed prostitutes; (5) if beyond the control of parents or guardians, or if refractory in a Poor Law school; (6) if habitually non-attendant upon the public schools; (7) if convicted for the first time, being under twelve, of an offense punishable by imprisonment.

As the Juvenile Court is yet unknown in England, the commitment usually takes place through a justice or police court. Any person may bring a child into court and if the magistrate finds that the child comes under one of the above descriptions, he may send him to a certified industrial school. A few of the industrial schools, however, receive voluntary cases, *i. e.,* those brought by parents or guardians without a magisterial order. In this case, parents or friends must pay for the care of the child. Magistrates must send children to schools conducted in accordance with the religious persuasion of the children's parents.

A child may not be detained in an industrial school beyond the age of sixteen, except with its own consent in writing. But by an Act of 1894 the managers of a school are entrusted with the supervision of children committed to them to the age of eighteen. After eighteen months of detention a child may be "placed out on license" with any trustworthy person. The license may be revoked at any time and the child recalled to the school if the managers think it necessary for the protection of the child. A child above the age of ten, who remains refractory, may be sent to a certified reformatory school.

The industrial training given in the industrial schools has been much improved within the last few years. Now the best schools employ competent teachers who give technical instruc-

tion of a high grade, both theoretical and practical. The efficiency of the schools is, however, greatly injured by lack of classification, especially classification according to age. Usually children of all ages from seven to sixteen and of very different characters are found together in one school without much attempt at classification. In spite of this and other drawbacks, the industrial schools seem fairly successful in their work of reclaiming wayward children. It is estimated that about eighty per cent of the boys who pass through these schools do well in after life.

(3) Truant schools are provided by school boards under the Elementary Education Act of 1876 for children who are habitual truants from the public schools. On account of the short period of detention of children committed to them, these schools have not been particularly successful.

(4) Day industrial schools may also be provided by school boards if the Secretary of State thinks them desirable for the proper training and control of the children on account of the circumstances of any class of the population of a school district. They differ from truant schools in that any children who may be sent to industrial schools may be committed to them as well as truants; and also in that the period of detention in them is much longer than in the truant schools, though it must not exceed three years or go beyond the age of fourteen. Children are committed to the day industrial schools by magistrates in the same manner as to the certified industrial schools. They are also received without a magisterial order upon request of a parent and a local authority. In these schools the children are detained only during the day, as their name implies, being allowed to return to their own homes after school hours. They are said to be most successful.

CHAPTER III

Private Charity in England

It has been claimed as one of the chief merits of the English public relief system that by the sharp delimitation of its field it gives ample room for the growth of a system of private charity alongside of it.[1] Every fully destitute person is entitled to relief under the Poor Law, and so is properly a public charge; on the other hand, those who need aid and yet are not "fully destitute" are the proper objects of private charity. By thus giving private benevolence a definite field to work in there is no doubt that, on the one hand, the Poor Law has avoided the danger of drying up private benevolence, while, on the other, it has encouraged the development of a rational system of voluntary charity. But it must not be supposed that the division of labor between public relief and private charity in England is a hard and fast one. On the contrary, there are continual overlappings and duplications of the public and private systems, just as there are in other countries. Thus every form of activity discussed in the preceding chapter, under public relief, is duplicated by private effort. Nor does the State longer rigidly confine public relief to the fully destitute. Especially in the case of the defective classes, the deaf-mutes, the blind, the feeble-minded, the epileptic, and the insane, is the tendency manifest for the State to take upon itself the entire charge for the education or care of these classes. On the other hand, private philanthropy has always cared for a certain proportion of

[1] Aschrott, *Armengesetzgebung in Grossbritannien.*

the fully destitute in England. Members of the upper and middle classes who become dependent have always largely been cared for by private charity; while in recent years an increasing number from the respectable laboring classes, who have become dependent, are so cared for.

We have no statistics of the number who receive relief from private sources in England. But from the extent and wealth of charitable institutions and societies one would judge that the number who receive their benefits can not be much smaller than the number who receive public relief.

1. ENDOWED CHARITIES.[2] The most important private charities in England are endowed charities. These include not only foundations for educational and religious purposes, but also for private almshouses, for pensions for the aged poor, for relief of the sick, for fuel, food, and clothing, and for gifts in money, or doles. Many of these endowments are very ancient, having been created in the sixteenth and seventeenth centuries, and even earlier. Thus most of the endowments for private almshouses, which are very numerous, were created in the sixteenth and seventeenth centuries during the incipience of the Poor Law, when the Government encouraged such gifts to supplement public relief. Such ancient endowments are often of a purely local character, being limited in their scope to a particular parish and controlled by the parish officials; or they are connected with some ancient guild or craft, having been originally created for the relief of its poorer members.

The extent of these charitable endowments in England is very great. In 1818 a commission was appointed to investigate endowed charities, which finally completed its report in 1837.

[2] See Kenney, *Endowed Charities*, and *Annual Charities Register and Digest*, pp. cxlvi-cxlix.

This report enumerated 28,820 charitable endowments, whose gross aggregate income was over £2,000,000 annually and which held in possession over 523,000 acres of land. Since then the number and extent of charitable foundations have increased enormously. It is, indeed, probable that the endowments of the nineteenth century exceed in extent those of all the previous centuries combined. A new digest of endowed charities in England and Wales is now being compiled by the charity commissioners, but has not yet been issued.

Judicial and administrative control over endowments has in recent years become an important public question. It has been a difficult matter to harmonize many of the ancient endowments with the conditions of modern life. Indeed, in many cases, the objects for which the endowments were made no longer exist. Thus we have endowments for the ransom of prisoners captured by pirates, or for the relief of those imprisoned for debt. In many more cases, the objects for which the endowment was created are now regarded as harmful to society, such as the giving of doles in money or kind. To meet these conditions a Board of Charity Commissioners was established in 1853, and has since then had its powers considerably enlarged. This is primarily a board with inspective and supervisory powers, rather than a board of control. Through a staff of inspectors the commissioners inspect the bulk of charitable endowment annually. The light thus thrown on the working of endowments has of itself done much to effect their improvement. The charity commissioners have the further important power of remodeling arrangements for the administration of a charitable endowment in certain cases. All small endowments, the income from which does not exceed £50, may be thus remodeled. But if the income from an endowment

exceeds £50 a year, the commissioners can not remodel its administration, unless requested to do so by the trustees themselves. This is a mischievous limitation, and practically makes impossible the reform of some of the most antiquated, if not absurd, charitable endowments in England.

There is but one possible remedy in cases where the trustees of a useless or mischievous endowment refuse to apply for a scheme to remodel its administration: the charity commissioners may carry the case to the Court of Chancery, which is now a part of the High Court of Justice. This court has jurisdiction not only to compel trustees to perform the trusts reposed in them, but also to remodel the arrangements of an endowment if the particular objects contemplated by the founder no longer exist, or if the details prescribed by him are found unworkable. But unfortunately the court has disclaimed the power of remodeling arrangements made by the founder merely because they are inconvenient or even pernicious to society. All attempts to remove by act of Parliament this inability of the court and of the charity commissioners to deal with mischievous endowments, have thus far failed. Thus there are at present in England, no legal means to remold charitable endowments which have come to be regarded as harmful to society.

2. ECCLESIASTICAL CHARITY.

(1) *The Church of England.*[3] The secularization of the relief system which followed the Reformation did not destroy the charitable activities of the Church. On the contrary it left the Church free to develop its charity along more natural lines. The burden of the general relief of the poor was always one

[3] The facts given in this section have been obtained largely from the *Church of England Year Book*, issue of 1895.

which the Church was unfitted to bear, and an ecclesiastical relief system must have proved a failure sooner or later in any course of development. The freeing of the Church from this burden then, gave it opportunity to expand along the lines of voluntary benevolence; and of this opportunity the Church of England has made the largest possible use.

Many of the endowed charities discussed under the last head are, in effect, church charities, since the controlling trustees are church authorities—churchwardens, vicars, bishops, or other church officials. Some of the ancient endowments were confiscated or secularized during the reign of Henry VIII, but many more remained intact under practical church control. The charities supported by these ancient endowments include, as we have seen above, numerous almshouses, gifts for education, apprenticing, pensions, and doles of money, food, and clothing. These charities are unfortunately often narrow in their scope, being limited frequently to the members of a single church or parish, and to objects which are now considered questionable.

The more recently established charities of the English Church, however, partake of the broad and enlightened humanitarianism of the nineteenth century,[4] and cover almost every object of philanthropic endeavor. Thus in the field of the care of the sick the Church maintains seventy-four cottage hospitals and eight special hospitals; thirty-four convalescent homes for men and women, twenty-three for women and children, twelve for children only, and eight for gentlewomen—all of these institutions being conducted on a charitable basis. Besides, to care for the sick poor in their own homes the Church has

[4] For an account of the social work of the English Church and dissenting churches, see R. A. Woods' *English Social Movements.*

twenty-six institutions which train and send out visiting nurses.

In the realm of general relief work the Church has twenty-seven sisterhoods, each with numerous branches, devoted to charitable work. These, as well as several orders of deaconesses, undertake along with religious work various forms of charitable work, such as the care of orphan children, of the aged, or of the sick, the training of poor girls for domestic service, and the visiting and relief of the poor in their homes. There are also several church societies, such as the "Metropolitan Visiting and Relief Association," whose purpose is the visitation and relief of the poor in their own homes along with religious work.

Among the most successful and extensive charities of the Church of England are those which are included in the "Reformatory and Refuge Union." Such is the Children's Aid Society which had aided, up to 1895, over 11,000 dependent and neglected children. Such also is the Church of England Society for Providing Homes for Waifs and Strays. This society has eighty-five homes, all of small size, the largest having a capacity of not more than forty. In 1895 these homes contained 2,250 children, besides which 540 were boarded out in families, 165 placed in service, and twenty-four assisted to emigrate. Finally, the Reformatory and Refuge Union includes the twenty-six reformatory and industrial schools for boys and the nineteen similar institutions for girls maintained by the Church of England. All of these schools are certified by the Local Government Board as fit to receive children committed by magistrates under the circumstances mentioned in the preceding chapter.

Closely allied to this work is that of the Church Penitentiary Association. This association maintains forty-four "penitentiaries" or homes for penitent fallen women. In these they

are kept from three months to three years and fitted to return to normal social life. The association has also fifty-three temporary refuges where penitents are received on probation for a short time preparatory to their entering the above homes.

Besides the institutions for dependent children noted above, the Church maintains sixteen orphanages for boys, forty-two orphanages for girls, and twelve for both boys and girls. The majority of these institutions are of moderate or small size, although some of them are large, containing as many as three hundred children.

Among the many benevolent societies supported by the Church for special objects, we can notice only one, and that is the "After-Care Association," for the care of poor persons discharged from the insane asylums. Its object is "to facilitate the re-admission of poor convalescents from lunatic asylums into social life," by obtaining for them, when needful, a change of scene, by assisting them to obtain suitable employment, and by grants of money and clothing. The work of this society has been highly commended; and it illustrates the charitable activity of the Church at its highest level.

(2) *The Roman Catholic Church.*[5] Next after the Church of England, the greatest development of charitable activities among English religious denominations is to be found in the Roman Catholic Church. This is perhaps because the traditions of charitable work have been more continuous and permanent in this denomination than in other branches of the Christian Church. Whatever may be the cause, the Roman Catholic Church in England has now extensive charities covering almost every aspect of philanthropic work.

[5] The facts in this section are taken mainly from the *Catholic Directory, Ecclesiastical Register and Almanac*, 1894.

In the field of general relief work, the most extensive and important organization is the St. Vincent de Paul Society. This society adopts wholly modern methods in its relief work. It investigates carefully all cases applying for aid, it keeps a record of these cases, it co-operates with other relief societies, and it sends visitors to the homes of the poor. The society has branches in all large cities, and in the larger cities many local branches. In London alone there are, for example, twenty-nine of these local branches, or "committees," of the St. Vincent de Paul Society.

There are several other societies for the relief of the poor. Among these are the societies for the relief of the aged poor, like the Benevolent Society for the Relief of the Aged and Infirm Poor, the oldest Catholic charity in England. This society grants pensions to poor Catholic persons above the age of sixty. The Little Sisters of the Poor have as their special object the care of the aged poor in institutions. They are by far the most important organization engaged in this special branch of philanthropic work. They have twenty-eight houses in England, many of them being large institutions. In these homes for the aged, both sexes and all denominations are received and cared for. An institution which carries on a similar work is Nazareth House in London, which has twelve branches in the provinces.

In the field of the care of the sick poor the Catholic Church has in England eighteen hospitals and convalescent homes conducted on a charitable basis. It maintains also eleven societies for nursing the sick poor in their own homes, and a number of homes for incurables. The various sisterhoods devote themselves largely to the nursing of the sick and the education of poor children.

The care of dependent and neglected children has always occupied a prominent place in the charitable work of the Catholic Church. The Church maintains in England eleven Poor Law schools for boys and twenty-five for girls which have been certified by the Local Government Board as fit to receive dependent children committed to them by the boards of guardians. It has also five certified reformatories for boys and two for girls for the reception of delinquent children between twelve and sixteen guilty of serious offenses. For delinquent children under fourteen, guilty of minor offenses, the Church maintains twenty-seven certified industrial schools, fifteen for boys and twelve for girls. In England dependent, neglected, and delinquent children of Catholic parentage must by law be committed to these certified Catholic schools. In addition to such schools, the Catholic Church in England has about forty other schools, orphanages, or homes, for boys or girls.

The Catholic Church in England has numerous other charities, such as homes for fallen women, institutions for the blind and the deaf, etc.; but the above gives a fair outline of the range of its charitable activities.

(3) *The Salvation Army.* Among the newer religious denominations in England, none have attempted more extensive philanthropic work than the Salvation Army. This sect was founded in 1865 by the Rev. William Booth, now known the world over as General Booth. It was first called the "East London Mission," then the "Christian Mission," and finally in 1878 took the name of Salvation Army. In 1890 General Booth published his book, "In Darkest England and the Way Out," in which, after picturing the condition of the poorer classes of London, he proposed his plan of removing the more wretched of them to the country and rendering them self-supporting

through agriculture. He estimated that he could make this plan a success if £1,000,000 were donated. The money was soon forthcoming, and this formed the nucleus for the now extensive charities of the Army.

According to the report of the English division of the Salvation Army for the year 1900, the Army had in England twelve farm colonies, comprising 25,562 acres, with 650 colonists. These colonies were connected with similar farm colonies in English countries across the sea for the purpose of assisting emigration. They were also indirectly connected with sixty workshops in the cities for the temporary employment of the unemployed. In these, in 1900, 48,512 men and women were given temporary employment. Besides, the Army maintained thirty-six labor bureaus through which 6,367 individuals were found situations.

In addition to this strictly industrial work, the Army has many other charities. It has 188 shelters and food depots providing sleeping accommodations for 14,041 homeless men and women. In these, in 1900, over 6,137,000 meals were given away or served at nominal prices. Again, the Army has 132 slum posts, and maintains ninety-four rescue homes for fallen women. In 1900 these dealt with 5,158 girls, of whom 3,449 were reported as satisfactory cases. The children's homes and day nurseries supported by the Army number seventeen, and in 1900 these gave temporary shelter to 23,425 children. It has eleven homes for ex-convicts through which 1,626 discharged prisoners passed in 1900 with satisfactory results in 1,393 cases. Finally, there are a number of other social institutions of a miscellaneous character maintained by the Army.

In 1900 these 609 institutions were cared for by 2,294 officers and had an income from all sources of over £1,000,000

annually. The report further states that the rate of growth of the social and philanthropic institutions of the Army is extremely rapid.

It is to be regretted that these extensive charities of the Salvation Army are not always carried on in accordance with modern methods. While they are accomplishing much good, it is claimed by some that by giving relief too indiscriminately they are increasing some dependent classes, especially tramps and vagrants.[6] Of course, the sanguine expectations of General Booth, with regard to his plan of uplifting the submerged classes through returning them to agricultural life, have not been realized.

(4) *Other Protestant Churches.* Of late years other Protestant denominations in England, as elsewhere, have been increasingly turning their attention to philanthropy as an appropriate field of religious activity. The writer has been unable to obtain the statistics of the philanthropic work of the various non-conformist Protestant denominations in England. But the philanthropic work of these bodies is now beginning to be proportionate to their wealth and membership. The various Methodist churches, in particular, have led in this movement to give wider scope to the philanthropic activities of the Protestant churches; but other non-conformist churches have not kept far behind them. The philanthropic work of the Quakers, or Friends, deserves special mention also; for this little denomination has emphasized from the beginning the philanthropic aspects of Christianity.

[6] The shelters of the Salvation Army especially have been sharply criticised. It is said with good reason that these shelters attract vagrants; for they receive all comers without investigation and without any labor test. It has also been shown that they are centers of contagion for various diseases. They render nugatory much of the Poor Law legislation aimed at the vagrant class.

(5) *Jewish Charities.* It is perhaps hardly proper to classify Jewish charities among ecclesiastical charities, as they belong to a race as well as to a religious denomination. It is appropriate here, however, merely to note that no other religious denomination in England has so well organized a system of charities as the Jews. Their charities cover almost every object of philanthropic endeavor, and are usually administered according to the most modern methods by trained, intelligent officials. Unfortunately the writer has been unable to obtain any statistics as to the amount of Jewish benevolences in England. But the extent and organization of Jewish charities would seem to indicate that they are proportionately greater than in many other denominations.

3. THE WORK OF BENEVOLENT AND FRATERNAL ORGANIZATIONS. Non-sectarian charities of every sort are abundant in England. Many of the charities of the churches above mentioned are non-sectarian so far as their spirit and aim are concerned; but their more or less close connection with some religious denomination makes it necessary to classify them as ecclesiastical. Secular or non-sectarian charitable societies or institutions—that is, those having no connection with any religious denomination—exist in England for the care of almost every class of dependents. There are societies for the education and relief of the blind and the deaf, for the care and nursing of the sick in their homes, for the support of hospitals of all sorts, for the care of the aged and the incurable, for the protection and care of children, for the rescue of fallen women, and for the giving of various forms of private relief. In brief, non-sectarian benevolent organizations duplicate, on the one hand, the work of ecclesiastical charity, and on the other, to some extent at least, the work of the public relief system. This might cause

some confusion, were there not strong tendencies toward co-operation at work.

The scope of this article will not permit any attempt at description of this vast network of private secular charities. An illustration or two will suffice to indicate their character. An example of such a charity founded by private initiative is the "National Incorporated Waifs' Association," or "Dr. Barnardo's Homes," as it is popularly called. This organization exists for the rescue and care of neglected and dependent children. It has connected with it some forty different institutions in England which care for over 3,000 children, besides three emigration depots in Canada. Its chief method of child-saving is through placing out dependent children in homes, especially in Canada, and since its founding by Dr. T. J. Barnardo, about thirty-five years ago, it has thus placed out over 10,000 children. A good illustration of a non-sectarian charity due to the co-operation of different religious denominations and benevolent societies is the "Hospital Saturday and Sunday Funds." These funds are raised by various churches, clubs, societies, and business corporations, and distributed among the various hospitals in proportion to the amount of charitable work which they do. The amounts contributed to the hospitals of London in 1901 by these two funds and by King Edward's Fund, a similar charity, aggregated £129,000.

Another class of charities of a purely secular character, and unendowed, are the various benevolent societies and institutions connected with the various professions and occupations. These have been growing of recent years in number and wealth, until now they exist for almost every important calling. Their purpose is to furnish charitable relief for the unfortunate members of the profession or occupation. These societies are of two

classes, those that distribute their benefits on a purely charitable basis within the calling, and those that distribute benefits only to those who have joined the society and paid a certain sum for a stipulated term of years.

Closely related to these latter are the so-called "Friendly Societies."[7] These are mutual benefit societies which pay to their members certain sums weekly in case of sickness, and at death a lump sum to cover burial expenses, and after death perhaps certain allowances to widows and orphans. The work of these societies, inasmuch as they are mutual insurance societies against destitution through sickness, death, or other misfortune, ought perhaps to be considered strictly under the head of preventive philanthropy; but because they are practically vast dispensers of relief to their members, they may be conveniently noticed here in connection with other benevolent organizations.

The importance of these Friendly Societies in the life of the English working classes is beyond measure. Not only do they encourage to the greatest degree habits of thrift, industry, manly independence, and sobriety, but their probable future development seems to preclude the necessity of any such scheme as state old-age pensions to the laboring classes. In 1902 the number of Friendly Societies in Great Britain was 29,985, counting each local organization as a society. These societies had invested funds amounting to £37,917,702, and a total membership of over 11,424,000. As regards industrial extent the societies are of two classes, the trade societies, or trades unions, whose membership is strictly confined to one industry; and the general friendly societies which take in members without regard to occupation. As regards territorial extent, the societies are also of two classes. Many are purely local societies which have

[7] See *Annual Charities Register and Digest.*

no branches; others are societies of national extent with numerous branches. Among the friendly societies of national extent, not confined to any trade or industry, the largest and most important are the Oddfellows and the Forresters.

Parliament has recognized the importance of the work of the friendly societies, and has established a friendly societies' registry, in which societies that conform to certain conditions of the law may be registered. These registered societies must have their accounts audited annually by a government auditor, and are otherwise subject to legal control. But in return for this they have certain privileges which unregistered societies have not.

4. PRISONERS' AID SOCIETIES.[8] A form of philanthropy peculiarly well developed in England is that expressed by Prisoners' Aid Societies. This might also be classed as a phase of preventive philanthropy, but it is restorative in character, and may be conveniently discussed under a separate heading.

There are sixty-one prisons in England, and all have associated with them a voluntary society to aid discharged prisoners in making a fresh start in life. That is, there are more than sixty such societies in England and Wales. Since 1896 these societies have been made subject to governmental inspection and supervision, and those which attain a certain standard of efficiency receive a small grant from the Government to help them carry on their work. In 1900 the Prisoners' Aid Societies of England assisted 28,980 discharged prisoners.

The best of these societies not only find employment for discharged prisoners, and assist them by grants of money or clothing, but also have connected with them industrial homes or refuges for ex-convicts where they can receive training

[8] See *Annual Charities Register and Digest*, 1902, pp. 425-431.

which will fit them to re-enter free social life. In other words, they aim at continuing the work of the reformation of the prisoner after his discharge. Thus the prisoner who wishes to reform is surrounded at once, upon his discharge, with helpful influences which not only find him employment and restore him to family and friends, but equip him for work as well.

Different societies co-operate with each other, acting mutually as agents, taking charge of cases coming from districts other than their own. Again, to secure continued oversight over a discharged prisoner who has been procured employment in a distant place, corresponding members are appointed who look after such discharged prisoners. Thus this network of prisoners' aid societies in constant communication with one another makes it possible to exercise a kindly surveillance over a prisoner who wishes to reform, long after his discharge, and to prevent his being led again into crime.

The result of the work of these societies to England must be not only a great diminution of the class of habitual criminals, but also to some extent a diminution of the pauperism and vagrancy which so frequently follow crime.

5. CHARITY ORGANIZATION SOCIETIES.[9] The crown of the English system of public and private philanthropy is the Charity Organization Society. Although strictly a voluntary organization, it co-ordinates public and private relief agencies, and so is the keystone, in every locality in which it exists, which binds together the two systems of public relief and private charity. That England gave birth to the charity organization movement testifies not only to the superior humanitarian spirit of the English people, but also to their practical genius for har-

[9] See Loch's *Charity Organization*; also R. A. Woods' *English Social Movements*.

monizing private initiative with public activity in philanthropic work.

The first charity organization society was organized in London in 1869. The preceding years had been years of industrial depression; and, though relief was abundant, as Mr. Loch says, "Misery and destitution, seemed to increase in spite of it, seemed almost to feed and multiply upon it." It was evident that closer co-operation was needed between the Poor Law authorities and the dispensers of private charity. Immense emergency funds and prodigal private giving were nullifying the effect of the Poor Laws. Organization and co-ordination of public and private sources of relief became indispensable to prevent the spread of pauperism and the wholesale demoralization of the poorer classes. Accordingly, Mr. Goschen, then President of the Local Government Board, the Bishop of London, the Earl of Shaftesbury, Edward Denison, and others, took the lead in organizing a voluntary society which should bring about effective co-operation between private charities and Poor Law officials, and amongst private charities themselves; and which should secure due investigation and fitting action in all cases, and repress mendicity. This was called the London Society for Organizing Charitable Relief and Repressing Mendicity, a title which was soon popularly abbreviated into "Charity Organization Society."

This society was successful from the first in greatly reducing pauperism in London. By its methods and plan of organization it has made itself a model for similar organizations throughout the English-speaking world. In Great Britain there are now about one hundred similar societies, in the colonies about twenty, while in the United States there are over

150 such societies. Such societies now exist in practically all of the important cities of the English-speaking world.

As we have seen from this brief sketch of the history of the movement, charity organization societies are not primarily relief-giving organizations. Rather they exist to correlate and systematize the activities of relief-giving agencies already in existence. If a charity organization society gives relief largely, it runs the danger of coming into competition with other relief societies, and so destroying the possibility of friendly co-operation. As Mr. Loch says, "The society does not do the work of charity for the charitable; it is itself but a combination of charitable persons, each of whom, with the advantages of co-operation and a definite plan of work, ought to be the better able to fulfil his individual duties. It is not the desire of the society to supersede local charitable agencies, but to be representative of all such within their area—to afford means of mutual assistance and a place of meeting common to all who are engaged in charitable work."

Again, another reason why charity organization societies should not give relief largely is that they are in danger of losing sight of the higher aims of the society in relief-giving. The society aims at the cure of poverty by the rational co-ordination of the charitable efforts of individuals, private associations, and public authorities; by securing intelligent action in each case based upon a careful investigation of the facts; and by the rehabilitation of the individual through encouragement in habits of independence, thrift, and industry.

In general, it may be said that English societies adhere to these principles, and give no relief except in cases in which relief can not be obtained from co-operating agencies, and in emergencies pending investigation. But some societies have

departed widely from this rule, and have given large amounts of relief, to their detriment, it has generally been found, as co-ordinating agencies.

Some further explanation of the principles upon which charity organization societies work may be helpful. No case is recommended for relief until there has been thorough investigation by some officer of the society, usually by a paid agent, though sometimes by a volunteer. This investigation, if properly conducted, accomplishes three things: (1) it reveals the causes of distress; (2) it shows in what way help can best be given; (3) it detects imposture, if there is any, and so protects the giver. The facts ascertained through investigation are carefully recorded and filed in a registry of cases in the central office. This registry of cases is an efficient means of furthering co-operation between different charitable agencies, as from it fairly full information can be obtained regarding a case applying for relief. Beyond the work of investigation and registration is the task of restoring the dependent person if possible to self-support. This is mainly accomplished by English societies through the "almoner," the person who administers the relief, who makes relief conditional upon the performance of certain acts which tend toward self-support. "Friendly visiting" is not attempted by English societies in the same way or on the same scale as is attempted by American societies. So far as it is attempted at all it is done by the "almoner," or by "District Visitors" who work under the supervision of some church, without any direct connection with the charity organization society.

This brief review of the principles which govern the working of charity organization societies shows that they are a product of the combination of the humanitarian with the scientific spirit. They stand, on the one hand, for the perception of the

superiority of intelligent and united effort; on the other, for the perception that charity has a higher duty to the unfortunate than the giving of mere material relief; that it should aim at the permanent welfare of the poor rather than the temporary alleviation of misery. The charity organization movement is, therefore, pre-eminently constructive, not negative and repressive, as it is so often represented to be; and, on the whole, it must be judged to be one of the highest expressions of intelligent philanthropy which the world has yet seen.

The plan of organization of English charity organization societies needs a word of explanation. The London society may be taken as typical, the plan being simplified for smaller communities. The London society consists of a Central Council or Committee with forty District Committees. The central council has general oversight of the work of the society, especially of the district committees. It endeavors to bring into systematic co-operation all charitable institutions and agencies, both public and private. It seeks to improve the administration of charity in every way, and to diffuse knowledge concerning the proper methods of relief. The council itself itself does not receive direct applications for aid, but these must be made through the district committees. The council is composed, aside from its chairman, vice-chairmen, and treasurers, (1) of elected representatives from each district committee, together with the chairman and honorary secretaries of the committee; (2) of additional members from the society at large, not exceeding in number one-fourth of the representatives of the district committees; (3) of representatives from metropolitan charitable institutions.

The district committees are local branches of the society, now forty in number, formed in each Poor Law union of Lon-

don for the purpose of carrying out in that district the practical work of the society. Their function is to receive, investigate, and treat, in accordance with the principles of the society, all applications for relief referred to them in their respective districts. The district committees are supposed to be financially independent of the council and to be self-supporting in their work. But about half of them receive grants from the council toward their administrative expenses. They are composed, so far as possible, of ministers of religion, guardians of the poor, and representatives of local charities. For the performance of their work, the district committees have several sorts of executive officers. Sometimes a paid secretary is employed, but generally the work is in charge of one, or more, honorary secretaries who serve without pay, yet give a great deal of time to the work. In poorer districts, the work is in charge of district secretaries who are appointed and paid by the council. Besides the secretaries there are in every district office, one or more paid investigating agents or inquiry officers. Upon these devolve most of the work of investigation, and sometimes of receiving applications. Finally, the district committees usually enlist a considerable number of volunteers to act as almoners and visitors, and sometimes to assist in investigation.

While relief may be given by the secretary pending investigation, if the case is one of emergency, the rule is that no recommendation regarding the case is made until it comes before the whole committee for decision. In other words, "all decisions are made in committee." If the case is one in which permanent relief is needed or in which pecuniary aid is likely to do no good, on account of evil habits, it is at once turned over to the Poor Law officials. The only exceptions to this rule are the cases of aged or infirm persons who have led respectable, in-

dustrious lives; for these the society undertakes to provide suitable pensions or to secure homes. If the case is one in which only temporary relief is needed, or in which there is hope of restoration to self-support, the committee undertakes to find suitable and adequate relief either from charitable institutions and societies or from benevolent private individuals. Finally, there are the cases which are rejected as not needing relief.

This plan of organization is modified in smaller cities, so that a single committee, usually called the council, carries on the whole work of the society.

Into further details of the work of charity organization societies in England it is not necessary to enter. Our purpose has been simply to show how this work is correlated with the whole system of public and private philanthropy in England. Enough, perhaps, has been said to make it evident that the work of these societies is truly constructive, being both preventive and remedial; and so is a necessary complement to the work of the Poor Law, which is almost wholly repressive.

6. Preventive and Educational Work. Into the vast field of preventive philanthropy in England, both governmental and voluntary, it is impossible to enter and keep within the scope of this monograph. Only a few examples can be given as indications of the work which is now being attempted by the Government and by voluntary associations along these lines. In general it can be said that in England as elsewhere more and more attention is being given to the work of prevention. A few illustrations will be given.

(1) Among the numerous things attempted by the English Government in the way of prevention, perhaps the Employers' Liability Act and the Post Office Savings Banks are the most striking. The Employers' Liability Act, together with

the supplemental Workmen's Compensation Act of 1897, provides that a workman may recover damages from an employer for personal injury suffered while in his employ, provided the injury was not due to the workman's own negligence or willfulness. The damages so recoverable, however, shall not exceed in amount the estimated earnings of a workman of the same grade during three years preceding the injury. Where death results from the injury the workman's dependents have the same right to damages that he would have. In case of total or partial incapacity for work resulting from the injury lasting for more than two weeks, the compensation shall be a weekly payment not exceeding fifty per cent of the workman's average weekly earnings during the previous twelve months. The effect of these acts is, of course, greatly to diminish the dependency which so frequently results in our industrial civilization from accident or injury.

Through the Post Office Savings Banks the English Government affords unexcelled facilities for saving and thrift to the masses. At any post office in the United Kingdom, deposits may be made in sums from a shilling upwards. The amount of such deposits, however, may not exceed £50 in one year, and the total sum to one's credit may not exceed £200. After the sum deposited reaches one pound, interest at the rate of two and one-half per cent. per annum is paid on every complete pound. Withdrawals can be made at any time, after notice has been sent to the chief office, at any post office in the United Kingdom. No charge for postage is made to a depositor for any letter passing between him and the chief office on savings bank business. In many other ways the facilities offered by the Post Office Savings Banks are much superior to those of ordinary savings banks. Besides, every depositor in

these banks has the direct security of the Government for the repayment of his deposits. Thus the State in England has made itself the banker of the poor and their direct encourager in habits of thrift.

(2) The work of voluntary associations in the way of prevention is even more extensive than that of the Government.[10] In some cases they parallel the work of the Government, but in many other cases they do work which the State as such is unfitted to do. Thus, while the Post Office Savings Banks reach those who are inclined to be thrifty and encourage them to save, they cannot reach the unthrifty. For these there have been organized in all the large cities "Collecting Savings Banks." The savings of the most shiftless classes are collected at their homes by agents of these banks weekly. The canvass is made early in the week before the poor have had opportunity to spend their earnings. Any sum from one penny up is received. As most of these Collecting Savings Banks are conducted with a philanthropic aim, though upon a business basis, they encourage their depositors to open an account as soon as possible with a post office or other savings bank. Thus they mediate between the thriftless and the institutions of the thrifty, the regular savings banks. Similar in aim are the Penny Provident Banks established by some charity organization societies. The National Penny Bank, on the other hand, is an institution conducted wholly on a commercial basis, but by affording opportunity for making very small savings it helps to increase thrift among the poor. This bank has thirteen branches in London which had on deposit, December, 1900, £1,935,559.

[10] Perhaps the best account of the preventive work of voluntary associations in England is to be found in Woods' *English Social Movements*.

A good illustration of preventive work by voluntary associations is found in the Provident Dispensaries and Provident Medical Associations.[11] These aim to provide medical attendance for the poor who are unable to pay the ordinary charges of a physician, but yet are not proper recipients of free medical relief. They are to a certain extent a protest against the indiscriminate medical charity furnished by the free dispensaries. There are now about sixty such provident dispensaries and sick clubs in London alone. Their membership is usually restricted to families whose income is less than a certain sum—varying from 25s. to 50s.—a week. These families pay into the treasury of the dispensary or sick club from one to six pence a week, according to the size of the family and the expenses of the dispensary. In return they receive medical attendance from the medical staff of the dispensary, which is composed of reputable medical practitioners living in the neighborhood. Thus these dispensaries are conducted on the principle of mutual insurance. They teach the poor to provide for sickness by making small savings, while they assure them skilled medical attendance in their own homes or at the dispensary as a matter of right, not of charity. The Metropolitan Provident Medical Association is the most prominent organization conducted on these lines in London; it has numerous branches in different parts of the city, and over 30,000 members.

Societies for improving the dwellings of the poor are numerous in all of the larger cities of England. In London there are about twenty-five societies and semi-philanthropic corporations working along this line. The work of many of these, such as that of the Peabody Donation Fund, has been of international significance, but it can only be merely mentioned here. A good

[11] See *Annual Charities Register and Digest*, 1902, pp. 175-190.

example of the combination of business and philanthropy, which some of these companies make, is to be found in the Four Per Cent. Industrial Dwellings Company. This company, which owns a number of model tenements, so adjusts its rents that the net return to the stockholders annually does not exceed four per cent. The work of these companies and societies for improving the dwellings of the poor has been influential in bringing about governmental action in the matter. In 1890 Parliament passed the Housing of the Working Classes Act, enabling municipalities to purchase land or buildings for the purpose of erecting improved dwellings for the working classes. Nearly all the large municipalities of England have taken advantage of this act, and as a result some of the worst slums in English cities have disappeared. The London County Council has erected some fifty model tenement buildings under this act and has many more in process of erection.

Here must be mentioned the work of Miss Octavia Hill in improving the dwellings of the London poor. This work, begun by Miss Hill in 1864, has been a wonderful leavening influence in English philanthropy. It aims at improving the condition of the poor, first through elevating their personal character, then through bettering their material surroundings. This is accomplished through a system of lady rent-collectors who act as friendly visitors to the poor while acting as agents of the landlords in collecting rent. Miss Hill's plan is to take entire charge of blocks of buildings owned by individuals or companies, guaranteeing the owners four or five per cent. interest. She then assumes charge of the premises, abolishing some of the worst evils, such as living in cellars, and promising the tenants improvements if by their carefulness they are deserving of them. She relies upon her influence as rent-collector to lift

gradually the standards of the people in the care of their dwellings. After a time the profits from the rents are sufficient to make the needed repairs or even to erect a new building; but in the meantime the improvement in the character of the tenants through the influence of their lady friendly visitor, clothed with her authority as rent-collector, has been quite as striking as the improvements in the dwelling. This plan of employing lady rent-collectors who shall at the same time act as friendly visitors to the families from whom they collect rent, instructing them in the proper care of their homes, has been adopted by many of the improved dwellings companies as necessary to the success of their plans; but the spirit and the method of Miss Hill's work has had, besides, a world-wide influence.

Perhaps most people would agree that the highest expression of modern preventive philanthropy is to be found in the Social Settlement. That England originated the "Settlement idea," as well as so many other movements in modern philanthropy, is proof positive of the healthiness and sanity and depth of her philanthropic spirit. The "Settlement idea," is, briefly, that in order to help the poor we must live among them and share their life. But practically the English Settlements have become large institutions, usually located in the slum districts of cities, where all sorts of educational and social work is carried on for the laboring classes. There are now upwards of fifty University or Social Settlements in England and a voluminous literature upon their work.[12] It is possible here to notice only a few points concerning their history and activities.

The first settlement in England was established in 1885 in

[12] For a brief account of English Settlements, see Woods' *English Social Movements*, or Professor C. R. Henderson's *Social Settlements*.

memory of Arnold Toynbee and was called Toynbee Hall. The leading spirit in its establishment was the Rev. S. A. Barnett, who had been for several years Vicar of St. Jude's in East London. He appealed to the university men who wished to erect some suitable memorial for Toynbee to come and share their lives with the poor. The result was that both Oxford and Cambridge united in founding "Toynbee Hall." Here a colony of university men took up their residence, not merely to lecture and teach, but chiefly to mingle freely with the poor in a social way, to share their life, and to become in all respects one with them. The success of Toynbee Hall was so pronounced from the start that the movement soon became a general one. Other social settlements were rapidly established by various interests, educational institutions, and religious denominations, until the movement is now world-wide.

As has been implied, the work of the social settlements is not necessarily of a religious character. While some of the settlements are founded upon a religious or even a sectarian basis, the majority of them divorce their work entirely from any attempt at religious instruction. The activities of the settlement are, perhaps, first of all, educational. Not only are there regular courses of instruction in nearly all the useful and liberal branches of knowledge, but series of lectures by public and literary men as well. Much is made of art in all its forms, and the education of the esthetic faculties receives scarcely less attention than that of the intellectual. But it is chiefly as a civic and social center that the settlement fulfils its highest function. Not only are healthful entertainments of all sorts here provided for the people, but there are meetings in which political, economic, and social questions are discussed, and civic consciousness thus awakened. The activities of English settlements, in a word,

embrace the whole range of preventive and educational philanthropy, and thus they are justly entitled to the first place among preventive institutions.

It remains only, in concluding, to say a word about educational conferences upon charitable matters in England. These conferences are now well organized in England. Under the auspices of the London Charity Organization Society there is held every year a conference on matters pertaining to the work of charity organization societies and to the public and private relief of the poor in general. For Poor Law officials there are one central and ten district conferences, which hold annual meetings. At these "Poor Law Conferences," as they are called, papers are read on all phases of public relief. Thus the results of experience are gathered, presented, and diffused for the information of all, so assuring the growth and harmonious development of all parts of the public and private relief system.

BIBLIOGRAPHY

ASCHROTT, DR. P. F. The English Poor Law System, Past and Present; translated by H. Preston Thomas. London, 1888.

ASCHROTT, DR. P. F. Article, "Armengesetzgebung in Grossbritannien" in *Handwörterbuch der Staatswissenschaften.*

ASCHROTT, DR. P. F. Die Entwickelung des Armenwesens in England seit dem Jahre, 1885. Leipzig, 1898.

ASHLEY, PROF. W. J. English Economic History. 2 vols. New York, 1893.

ARCHBOLD, J. F. The Poor Law. Twelfth Edition, by W. Cunningham Glen, Esq. London, 1885.

BURN, DR. RICHARD. History of the Poor Laws. 1764.

CHANCE, SIR WILLIAM. Our Treatment of the Poor. London, 1899.

CHANCE, SIR WILLIAM. The Education and Care of Children under the Poor Law. London, 1897.

CHANCE, SIR WILLIAM. The Better Administration of the Poor Law. London, 1895.

DAVIS, J. E. Article, "Poor Laws" in Encyclopedia Britannica.

EDEN, SIR FREDERIC. The State of the Poor. London, 1797.

EMMINGHAUS, A. Poor Relief in Different Parts of Europe. London, 1873.

FOWLE, REV. T. W. The Poor Law. London, 1890.

GLEN, W. CUNNINGHAM. The Statutes in Force Relating to the Poor Laws. London, 1873.

HILL, FLORENCE DAVENPORT. Children of the State. London, 1889.

HOBHOUSE, SIR ARTHUR. The Dead Hand. London, 1880.

KENNEY, COURTNEY. Endowed Charities. London, 1880.

LEONARD, MISS E. M. Early History of the English Poor Law. Cambridge, 1900.

LOCH, C. S. Charity Organization. London, 1890.

LOCH, C. S. (Editor) Annual Charities Register and Digest, London, 1902.

LONSDALE, MISS SOPHIA. The English Poor Laws. London, 1901.

MACKAY, THOMAS. Public Relief of the Poor. London, 1901.

MACKAY, THOMAS. The English Poor; a Sketch of Their Social and Economic History. London, 1889.

MACKAY, THOMAS. Vol. III. of Nicholls' History of the English Poor Law. 1899.

NICHOLLS, SIR GEORGE. A History of the English Poor Law. 2 vols. Vol. III. by T. Mackay. London, 1899.

PASHLEY, ROBERT. Pauperism and Poor Laws. London, 1852.

RATZINGER, GEORGE. Geschichte der Kirchlichen Armenpflege. Freiburg-im-Breisgau, 1884.

REPORT of His Majesty's Commissioners for Inquiring Into the Administration of the Poor Laws. London, 1834.

REPORT of The Poor Law Commissioners. London, 1839.

REPORTS of the Local Government Board, especially the 30th and 31st. London, 1902, 1903.

UHLHORN, GERHARD. Article, "Geschichte der öffentlichen Armenpflege" in *Handwörterbuch der Staatswissenschaften.*

WOODS, R. A. English Social Movements. New York, 1891.

YEAR-BOOK of the Church of England. London, 1902.

Various Encyclopedias have valuable articles, such as Bohn's Cyclopedia of Political Knowledge and Palgrave's Dictionary of Political Economy.

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But what right have we to pass from particulars to universals? Aristotle seems to justify the procedure in two ways. The particular, he believes, arouses in the mind the universal. We perceive the particular, *e. g.*, Callias, but perception includes the universal, *e. g.*, man.[3] That is, the perception of the particular arouses in our minds the idea of the universal, of the all. In the words of Thomas Taylor, a translator and commentator of Aristotle: "Induction is so far subservient to the acquisitions of science, as it evocates into energy in the soul, those universals from which demonstration consists. For the universal, which is the proper object of science, is not derived from particulars, since these are infinite, and every induction of them must be limited to a finite number. Hence the perception of the *all* and the *every* is only *excited,* and not *produced,* by induction."[4] In other words the category of totality seems to be a function of the mind that is aroused or excited by the perception of particular things. The mind makes the leap from the part to the whole.

In another place Aristotle tries to prove the inductive proposition deductively, that is, to justify the inductive leap to logic. He bases himself on the thought that we can enumerate all the species of the genus which occurs in our conclusion. Thus we conclude that whatever is devoid of bile is longlived, because every man, horse, mule, etc., is longlived, and what is devoid of bile is man, horse, mule, etc.[5] That is, only so-called perfect induction is capable of proof.[6]

The thought implied by Aristotle is that what is true of the

[3]*Posterior Analytics,* Bk. II, chap xix.

[4]Quoted in the English translation of the *Organon,* Bohn's library.

[5]*Prior Analytics,* Bk. II, chap. xxiii.

[6]See also, Whately, *Logic;* Apelt, *Theorie der Induction;* Jevons, *Lessons in Logic; Principles of Science;* Veitch, *Institutes of Logic.*

species is true of the genus, that the particular is an expression of the universal, that there is uniformity in the world. This is really the fundamental idea of his whole system of philosophy. The particular is an expression of the universal, of the form or idea, hence what is true of the particular must be true of the universal.[7]

§ 2. Bacon, too, regards induction as a passage from the particular to the general. But he suggests a more careful method of procedure. "For the induction which proceeds by simple enumeration is childish," he says; "its conclusions are precarious, and exposed to peril from a contradictory instance; and it generally decides on too small a number of facts, and on those only which are at hand. But the induction which is to be available for the discovery and demonstration of sciences and arts, must analyze nature by proper rejections and exclusions; and then after a sufficient number of negatives, come to a conclusion on the affirmative instances." [8] He also condemns hasty induction, and finds fault with the ancients for having employed it. "From a few examples and particulars (with the addition of common notions and perhaps of some portion of the received opinions which have been most popular), they flew at once to the most general conclusions, or first principles of science; taking the truth of these as fixed and immovable, they proceeded by means of intermediate propositions to educe and prove from them the inferior conclusions: and out of these they framed the art." [9] "There are and can be only two ways of searching into and discovering truth. The one flies from the senses and par-

[7]See Hegel's *Logik*. See also, *Posterior Analytics*, Bk. I, chap. xxxi.

[8]*Novum Organum*, Bk. I, cv. Quotations taken from the Spedding, Ellis, and Heath edition of Bacon's Works.

[9]*Nov. Org.*, Bk. I, cxxv.

ticulars to the most general axioms, and from these principles, the truth of which it takes for settled and immovable, proceeds to judgment and to the discovery of middle axioms. And this way is now in fashion. The other derives axioms from the senses and particulars, rising by a gradual and unbroken ascent, so that it arrives at the most general axioms last of all. This is the true way, but as yet untried."[10]

Bacon's whole aim is to devise a method that will yield us general propositions of greater certainty than those obtained by the method of simple enumeration. The problem is to find the form or essence of things, that on which the phenomenon under consideration depends. The form of anything is inherent in each individual instance in which the thing itself is inherent.[11] "The investigation of Forms proceeds thus; a nature being given, we must first of all have a muster or presentation before the understanding of all known instances which agree in the same nature, though in substance the most unlike."[12] Such a

[10]*Nov. Org.*, Bk. I, xix.

[11]*Nov. Org.*, Bk. II, xx; Bk. II, ii: "For though in nature nothing exists besides individual bodies, performing pure individual acts according to a fixed law, yet in philosophy this very law, and the investigation, discovery, and explanation of it, is the foundation as well of knowledge as of operation. And it is this law, with its clauses, that I mean when I speak of *Forms;* a name which I the rather adopt because it has grown into use and become familiar." Bk. II, iv: "For the Form of a nature is such, that given the Form the nature infallibly follows. Therefore it is always present when the nature is present, and universally implies it, and is constantly inherent in it," etc. Bk. II, xvii: "For when I speak of Forms, I mean nothing more than those laws and determinations of absolute actuality, which govern and constitute any simple nature, as heat, light, weight, in every kind of matter and subject that is susceptible of them." See also, Bk. II, iii, v, xiii, xv, xvi.

[12]*Nov. Org.*, Bk. II, xi.

list is called the table of essence or presence. "Secondly, we must make a presentation to the understanding of instances in which the given nature is wanting; because the Form, as stated above, ought no less to be absent when the given nature is absent, than present when it is present."[13] This is the table of deviation or of absence in proximity. "Thirdly, we must make a presentation to the understanding of instances in which the nature under inquiry is found in different degrees, more or less."[14] This is the table of degrees or of comparison. When all this has been done induction itself is brought into action. "The first work therefore of true induction (as far as regards the discovery of Forms) is the rejection or exclusion of the several natures which are not found in some instance where the given nature is present, or are found in some instance where the given nature is absent, or are found to increase in some instance when the given nature decreases, or to decrease when the given nature increases. Then indeed after the rejection and exclusion has been duly made, there will remain at the bottom, all light opinions vanishing into smoke, a Form affirmative, solid and true and well defined."[15]

It is apparently the business of the investigator to collect a number of different cases in which the phenomenon to be studied is present. Then he must collect cases in which it is absent, and also cases in which it varies. That which is always present when the phenomenon is present, and absent when the phenomenon is absent, and which varies with the phenomenon, is the sought-for form.

It is clear, Bacon unconsciously bases himself upon the principle that there is a necessary connection between things, and

[13] *Nov. Org.*, Bk. II, xii.
[14] *Nov. Org.*, Bk. II, xiii.
[15] *Nov. Org.*, Bk. II, xvi.

that it is the business of true induction to find this connection. He really assumes that there is uniformity in nature, that things are so connected that when one appears the other will appear also. This principle he does not attempt to justify; indeed, as we have already said, he is not conscious of it at all. Since, however, he rejects the theory of innate ideas, and accepts empiricism, it is safe to say that he would have explained this principle as a product of experience after the fashion of Mill.

§ 3. John Stuart Mill[16] defines induction as "that operation of the mind, by which we infer that which we know to be true in a particular case or cases, will be true in all cases which resemble the former in certain assignable respects. In other words, induction is the process by which we conclude that what is true of certain individuals of a class is true of the whole class, or that what is true at certain times will be true in similar circumstances at all times."[17] So-called perfect induction is not induction at all. Nor are those cases in mathematics induction, in which the conclusion is a mere summing up of what was asserted in the various propositions from which it is drawn. Nor is it induction to piece detached fragments together (the so-called colligation of facts).[18]

Mill finds the ground of induction in the principle of the uniformity of nature.[19]

"The proposition that the course of nature is uniform, is the fundamental principle, or general axiom, of induction. But it would be a great error to offer this large generalization as any explanation of the inductive process. It is itself an instance of

[16] *A System of Logic*, Bk. III.

[17] *Logic*, Bk. III, chap. ii, §1. See also, chap. i, §2.

[18] *Logic*, Bk. III, chap. ii, §§3,4.

[19] *Logic*, Bk. III, chap. iii.

induction, and induction by no means of the most obvious kind. Far from being the first induction we make, it is one of the last, or at all events one of those which are latest in attaining strict philosophical accuracy."

This great generalization, however, is itself founded on prior generalizations. "The obscurer laws of nature were discovered by means of it, but the more obvious ones must have been understood and assented to as general truths before it was ever heard of. We should never have thought of affirming that all phenomena take place according to general laws, if we had not first arrived, in the case of a great multitude of phenomena, at some knowledge of the laws themselves; which could be done no otherwise than by induction." [20] This principle is our warrant for all the other inductions in the sense in which the general propositions which we place at the head of our reasonings ever really contribute to their validity. The major premise of a syllogism does not prove the conclusion, but is a necessary condition of its being proved. Every induction may be thrown into the form of a syllogism, by supplying a major premise. "If this be actually done, the principle which we are now considering, that of the uniformity of the course of nature, will appear as the ultimate major premise of all inductions, and will, therefore stand to all inductions in the relation in which * * * the major proposition of a syllogism always stands to the conclusion; not contributing at all to prove it, but being a necessary condition of its being proved; since no conclusion is proved, for which there can not be found a true major premise." "The real proof that what is true of John, Peter, etc., is true of all mankind, can only be, that a different supposition would be inconsistent with the uniformity which we know to exist in the course of nature. Whether there would be this inconsistency or not, may be a matter of long and

[20] *Logic*, Bk. III, chap. iii, §1.

delicate inquiry; but unless there would, we have no sufficient ground for the major of the inductive syllogism. It hence appears, that if we throw the whole course of any inductive argument into a series of syllogisms, we shall arrive by more or fewer steps at the ultimate syllogism, which will have for its major premise the principle, or axiom, of the uniformity of the course of nature." [21]

The validity of all the Inductive Methods (Agreement, Difference, Joint Method, etc.) depends on the assumption that every event, or the beginning of every phenomenon, must have some cause; some antecedent, on the existence of which it is invaribly and unconditionally consequent. [22] This assumption is itself an instance of induction. We arrive at this universal law, by generalization from many laws of inferior generality. As, however, all rigorous processes of induction presuppose the general uniformity, our knowledge of the particular uniformities from which it was first inferred was not, of course, derived from rigorous induction, but by the loose and uncertain mode of induction *per enumerationem simplicem;* and the law of universal causation, being collected from results so obtained, can not itself rest on any better foundation. Induction *per enumerationem simplicem* is, however, not only not necessarily an illicit logical process, but is in reality the only kind of induction pos-

[21] *Logic*, Bk. III, chap. iii, §1.

[22] *Logic*, Bk. III, chap. xxi, §1. See also, chap. v, §2: "The Law of Causation, the recognition of which is the main pillar of inductive science, is but the familiar truth, that invariability of succession is found by observation to obtain between every fact in nature and some other fact which has preceded it." Section 6: But, "invariable sequence is not causation, unless the sequence, besides being invariable, is unconditional." "We may define, therefore, the cause of a phenomenon, to be the antecedent, or the concurrence of antecedents, on which it is invariably and *unconditionally* consequent."

sible.[23] The precariousness of this process is in inverse ratio to the largeness of the generalization. It is for this reason that the most universal class of truths, the law of causation, for instance, and the principles of number and of geometry, are duly and satisfactorily proved by that method alone, nor are they susceptible of any other proof.[24] The assertion, that our inductive processes assume the law of causation, while the law of causation is itself a case of induction, is a paradox, only on the old theory of reasoning, which supposes the universal truth, or major premise, in a ratiocination, to be the real proof of the particular truths which are ostensibly inferred from it. According to Mill's doctrine, however, "the major premise is not the proof of the conclusion, but is itself proved, along with the conclusion from the same evidence. 'All men are mortal' is not the proof that Lord Palmerston is mortal; but our past experience of mortality authorizes us to infer *both* the general truth and the particular fact, and the one with exactly the same degree of assurance as the other. The mortality of Lord Palmerston is not an inference from the mortality of all men, but from the experience which proves the mortality of all men; and is a correct inference from experience, if that general truth is so too. This relation

[23] *Logic*, Bk. III, chap. xxi, §2: "Is there not then an inconsistency in contrasting the looseness of one method with the rigidity of another, when that other is indebted to the looser method for its own foundation? The inconsistency, however, is only apparent. Assuredly, if induction by simple enumeration were an invalid process, no process founded on it could be valid; just as no reliance could be placed on telescopes, if we could not trust our eyes. But though a valid process, it is a fallible one, and fallible in very different degrees; if, therefore, we can substitute for the more fallible forms of the process, an operation founded on the same process in a less fallible form, we shall have effected a very material improvement. And this is what scientific induction does."

[24] *Logic*, Bk. III, chap. xxi, §§2,4.

between our general beliefs and their particular applications holds equally true in the more comprehensive case which we are now discussing. Any new fact of causation inferred by induction is rightly inferred, if no other objection can be made to the inference than can be made to the general truth that every event has a cause. The utmost certainty which can be given to a conclusion arrived at in the way of inference, stops at this point. When we have ascertained that the particular conclusion must stand or fall with the general uniformity of the laws of nature—that it is liable to no doubt except the doubt whether every event has a cause—we have done all that can be done for it." In matters of evidence as in all other human things, we neither require, nor can attain, the absolute. "Whatever has been found true in innumerable instances, and never found to be false after due examination in many, we are safe in acting on as universal provisionally, until an undoubted exception appears; provided the nature of the case be such that a real exception could scarcely have escaped notice. When every phenomenon that we ever knew sufficiently well to be able to answer the question, had a cause on which it was invariably consequent, it was more rational to suppose that our inability to assign the causes of other phenomena arose from our ignorance, than that there were phenomena which were uncaused, and which happened to be exactly those which we had hitherto had no sufficient opportunity of studying." [25]

[25] *Logic*, Bk. III, chap. xxi, §4. Mill goes on to say: "It must, at the same time, be remarked, that the reasons for this reliance do not hold in circumstances unknown to us, and beyond the possible range of our experience. In distant parts of the stellar regions, where the phenomena may be entirely unlike those with which we are acquainted, it would be folly to affirm confidently that this general law prevails, any more than those special ones which we have found to hold universally on our own planet. The uniformity in the succession of events, otherwise called the law of causation, must be received not as a law of the universe,

Mill too, we see, grounds induction on the proposition that things are connected in such a way that when one appears the other will appear also. This proposition itself is a product of experience, the result of loose induction.[26] But we are satisfied with this loose induction on account of the great number of particular cases observed by us in which we experience causality. Moreover, the particular case is not proved by the general proposition at all; the general proposition is proved by the particular cases. Hence, everything is ultimately reduced by Mill to induction; induction is the only possible process of inference; deduction is not inference at all, but a mere deciphering of our notes. "All inference is from particulars to particulars; general propositions are merely registers of such inferences already made and short formulae for making more. The major premise of a syllogism, consequently, is a formula of this description; and

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but of that portion of it only which is within the range of our means of sure observation, with a reasonable degree of extension to adjacent cases. To extend it further is to make a supposition without evidence, and to which in the absence of any ground from experience for estimating its degree of probability, it would be idle to attempt to assign any."

[26] *Logic*, Bk. III, chap. xxi, §1: Some metaphysicians affirm "that the universality of causation is a truth which we can not help believing; that the belief in it is an instinct, one of the laws of our believing faculty." But "belief is not truth, and does not dispense with the necessity of truth." "Now a mere disposition to believe, even if supposed instinctive, is no guarantee for the truth of the thing believed. If, indeed, the belief ever amounted to an irresistible necessity, there would then be no *use* in appealing from it, because there would be no possibility of uttering it. But even then the truth of the belief would not follow; it would only follow that mankind were under a permanent necessity of believing what might possibly not be true. * * * But in fact there is no such permanent necessity. There is not one of these supposed instinctive beliefs which is really inevitable. * * * It is not true, as a matter of fact, that mankind have always believed that all the succession of events were uniform and according to fixed laws. * * *

the conclusion is not an inference drawn *from* the formula, but an inference drawn *according* to the formula; the real logical antecedent or premise being the particular facts from which the general proposition was collected by induction. Those facts, and the individual instances which supplied them, may have been forgotten; but a record remains, not indeed descriptive of the facts themselves, but showing how those cases may be distinguished, respecting which, the facts, when known, were considered to warrant a given inference. According to the indications of this record we draw our conclusion: which is, to all intents and purposes, a conclusion from the forgotten facts. For this it is essential that we should read the records correctly: and the rules of the syllogism are a set of precautions to insure our doing so." "The proposition, All men are mortal (for instance) shows that we have had experience from which we thought it followed

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Even now a full half of the philosophical world, including the very same metaphysicians who contend most for the instinctive character of the belief in uniformity, consider one important class of phenomena, volitions, to be an exception to the uniformity, and not governed by a fixed law." Chap. xxi, §3, Note: "Dr. McCosh maintains that the uniformity of the course of nature is a different thing from the law of causation, and while he allows that the former is only proved by a long continuance of experience, and that it is not inconceivable nor necessarily incredible that there may be worlds in which it does not prevail, he considers the law of causation to be known intuitively. There is, however, no other uniformity in the events of nature than that which arises from the law of causation; so long, therefore, as there remained any doubt that the course of nature was uniform throughout, at least when not modified by the intervention of a new (supernatural) cause, a doubt was necessarily implied, not indeed of the reality of causation, but of its universality. If the uniformity of the course of nature has any exceptions—if any events succeed one another without fixed laws—to the extent the law of causation fails; there are events which do not depend on causes."

that the attributes connoted by the term man, are a mark of mortality. But when we conclude that the Duke of Wellington is mortal, we do not infer this from the memorandum, but from the former experience. All that we infer from the memorandum is our own previous belief, (or that of those who transmitted to us the proposition), concerning the inferences which that former experience would warrant." [27]

§ 4. According to Jevons [28] it cannot be said that the inductive process is of greater importance than the deductive process, because the latter process is absolutely essential to the former. Each is the complement and counterpart of the other. Induction is in fact the inverse operation of deduction, and cannot be conceived to exist without the corresponding operation. In deduction we deduce from certain conditions, laws, or identities governing the combinations of qualities, the nature of the combinations agreeing with those conditions. Our work is to unfold what is contained in any statements, and the process is one of synthesis. In induction all is inverted. The truths to be ascertained are more general than the data from which they are drawn. The process by which they are reached is analytical, and consists in separating the complex combinations in which natural phenomena are presented to us, and determining the relations of separate qualities.

Given events obeying certain unknown laws, we have to discover the laws obeyed. Instead of the comparatively easy task of finding what effects will follow from a given law, the effects are now given and the law is required. We have to interpret the will by which the conditions of creation were laid down.[29]

[27] *Logic*, Bk. II, chap. iii, §4.

[28] *Elementary Lessons in Logic; Principles of Science.*

[29] *Principles of Science*, chap. vii.

Being in possession of certain particular facts or events expressed in propositions, we imagine some more general proposition expressing the existence of a law or cause; and, deducing the particular results of that supposed general proposition, we observe whether they agree with the facts in question. Hypothesis is thus always employed consciously or unconsciously. Thus there are but three steps in the process of induction: (1) Framing some hypothesis as to the character of the general law. (2) Deducing consequences from that law. (3) Observing whether the consequences agree with the particular facts under consideration.[30]

[30] *Principles of Science*, chap. xii. Here Jevons seems to identify induction with scientific method in general, which is really a combination of induction and deduction. But there are passages in his Principles of Science, and particularly in his elementary work, which do not appear to be consistent with this interpretation. In chapter xi of the first-named book, for example, he says: "We must carefully avoid confusing together inductive investigations which terminate in the establishment of general laws, and those which seem to lead to the knowledge of particular events. That process only can be called induction which gives general laws, and it is by the subsequent employment of deduction that we anticipate particular events. If the observation of a number of cases shows that alloys of metals fuse at lower temperatures than their constituent metals, I may with more or less probability draw a general inference to that effect, and may thence deductively ascertain the probability that the next alloy examined will fuse at a lower temperature than its constituents." "I hold that in all cases of inductive inference we must invent hypotheses, until we fall upon some hypothesis which yields deductive results in accordance with experience. Such accordance renders the chosen hypothesis more or less probable, and we may then deduce, with some degree of likelihood, the nature of our future experience, on the assumption that no arbitrary change takes place in the conditions of nature." See also, *Lessons in Logic*, Lesson xxx, pp. 258f, quoted in the second part of this paper, page 35.

But the results of imperfect induction are never more than probable. "It is a question of profound difficulty on what grounds we are warranted in inferring the future from the present, or the nature of undiscovered objects from those which we have examined with our senses. We pass from Perfect to Imperfect Induction when once we allow our conclusion to apply, at all events apparently, beyond the data on which it was founded. In making such a step we seem to gain a net addition to our knowledge; for we learn the nature of what was unknown. We reap where we have never sown. We appear to possess the divine power of creating knowledge, and reaching with out mental arms far beyond the sphere of our own observation. Of imperfect induction itself, I venture to assert that it never makes any real addition to our knowledge, in the meaning of the expression sometimes accepted. As in other cases of inference, it merely unfolds the information contained in past observations; it merely renders explicit what was implicit in previous experience. It transmutes, but certainly does not create knowledge." The results of imperfect induction, however well authenticated and verified, are never more than probable. "We never can be sure that the future will be as the present. We hang ever upon the will of the Creator: and it is only as far as He has created two things alike, or maintains the framework of the world unchanged from moment to moment, that our most careful inferences can be fulfilled. All predictions, all inferences which reach beyond their data, are purely hypothetical, and proceed on the assumption that new events will conform to the conditions detected in our observation of past events. No experience of finite duration can give an exhaustive knowledge of the forces which are in operation. There is thus a double uncertainty; even supposing the Universe as a whole to proceed unchanged, we do not really know the Universe as a whole. We know only a point

in its infinite extent, and a moment in its infinite duration. We cannot be sure, then, that our observations have not escaped some fact, which will cause the future to be apparently different from the past; nor can we be sure that the future really will be the outcome of the past. We proceed, then, in all our inferences to the unexamined objects and times on the assumptions which are always uncertain: (1) that our past observation gives us a complete knowledge of what exists; (2) that the conditions of things which did exist will continue to be the conditions which will exist." [31]

Jevons identifies induction with specific method in general. But he also bases it on the principle that there are uniform connections in nature, and regards this principle as a product of experience.

§ 5. According to Sigwart, [32] the logical justification of the inductive process, that is, the attainment of universal prop-

[31] *Principles of Science*, chap. vii. Compare chap. xi: "We can only argue from the past to the future, on the general principle set forth in this work, that what is true of a thing will be true of the like. So far then as one object or event differs from another, all inference is impossible, particulars as particulars can no more make an inference than grains of sand can make a rope. We must always rise to something which is general or same in the cases, and assuming that sameness to be extended to new cases we learn their nature." "There is no reason in the nature of things, so far as known to us, why yellow color, ductility, high specific gravity, and incorrodibility, should always be associated together, and in other cases, if not in this, men's expectations have been deceived. Our inferences, therefore, always retain more or less of a hypothetical character, and are so far open to doubt. Only in so far as our induction approximates to the character of perfect induction, does it approximate to certainty." See also, on this point, Hamilton, *Discussions*; Veitch, *Institutes of Logic*; Benno Erdmann, *Logik*.

[32] *Logic*, vol. II, chap. v. The quotations are taken from Helen Dendy's English translation.

ositions from particular judgments of perception, rests upon the fact that it is an inevitable postulate of our effort after knowledge that the given is necessary, and can be known as proceeding from its grounds according to universal laws.[33] Every inductive inference contains a universal principle. If it is to be an inference and not merely an association of merely subjective validity, the transition from the empirically universal judgment all known A's are B's to the unconditionally universal all that is A is B, can only be made by means of a universal major premise; and that only upon condition of this being true are we justified in inferring from the particular known A's to the still unknown A's. But then the universal major premise cannot be obtained simply by means of a summation of facts, for this by itself can yield no more than it says, that is, a certain number of cases A was B and as a pure matter of fact contains no reason for passing beyond these A's to other A's.

The universal major premise must have some other origin than in previously observed facts, and our right to make use of it must have some other ground than the narration of cases which have been observed so far.[34] We shall never find in the given a sufficient ground to yield us the conviction that because so many perceived A's have without exception the attribute B, or because event B has followed so many times upon circumstance A, therefore it must *necessarily* be so. "The innumerable exceptions by which many attempted generalizations of this kind are met do as a matter of fact, refute, even to superfluity, the assumption that a universal law can be derived with infallible certainty from similar cases, however great their number. For a long time it is for most Europeans

[33] *Logic*, vol. II, chap. v, §93.

[34] *Logic*, vol. II, chap. v, §93, 8.

a good induction that all men are white; it is a good induction that all men have five fingers; for thousands of years it was a good induction that all metals are heavier than water." [35]

The universal proposition by which we are guided in our mental elaboration of the particular propositions given by perception is that the given is necessary; and since necessity signifies for us the same as the invariable and universal connection of a ground with a consequence, we get as the postulate of our search for knowledge that every particular perception is an instance of a general rule, a conclusion which follows from subordination to a universal major premise. This presupposition has reference both to the co-existence of the permanent attributes which we find in a particular object, and to the connection between the changes in the same or different objects; the concepts of things in which we synthesize certain perceptible attributes at first as subjective images, have objective significance just in so far as the connection is necessary, and there is a general rule according to which these attributes exist together in the particular case; the particular event is necessary when it happens according to a rule which prescribes that under certain conditions a certain change will take place. Hence it follows that we are forced by the nature of knowledge to apprehend all particular objects and facts with which observation presents us as instances in which a universal rule expresses itself; the problem of induction is to find this universal rule, and to formulate it in such a way that the given shall everywhere correspond to it. "In other words, we are dealing with a process of reduction, which constructs the premises from which the particular perception follows with syllogistic necessity, whether it expresses the co-existence of attributes in a thing, or a change, or the succession of different changes; and the problem is to determine these

[35] *Logic*, vol. II, chap. v, §93, 11.

major premises in such a way that they may be in harmony with all the perceptions known to us."[36]

From this it follows in the first place that the propositions gained by induction are never *proved* in the strict sense, but from a logical point of view are only hypotheses; further that the fundamental principles even of induction are based upon the rules of the syllogism, by which it is determined whether the premises assumed lead necessarily to the conclusion. If a perception does not agree with what is at first the assumed hypothesis of a universal proposition, then, assuming the process of inference to be correct, one of the premises is necessarily false; but the most comprehensive agreement of the hypothesis with the facts can never show it to be necessarily true, it can at most make it probable. When, however, any one hypothesis breaks down because the inferred universal proposition is opposed by exceptions, our universal presupposition that the given is necessary is not on that account destroyed; it is only the special assumption with reference to the necessary connection between a special ground and a special consequence which fails.[37]

Induction is a process of finding universal major propositions when the conclusions are given,—a reduction and therefore the reverse process of the syllogistic deduction from given major propositions. All induction consists in framing hypothetically universal propositions and comparing their consequences with the given.[38]

Sigwart, like Jevons, identifies induction with scientific method in general; it consists of forming hypotheses, deducing their consequences, and verifying them. The first step in the process, the passage from the particular to the universal, Sig-

[36] *Logic*, vol. II, chap. v, §93, 14.

[37] *Logic*, vol. II, chap. v, §93, 15.

[38] *Logic*, vol. II, chap. v, §93, 17. Note 2.

wart bases on the principle that the given is necessary: there is a necessary connection between things, they are related as ground and consequent so that when one appears the other must appear also. "Every particular perception is an instance of a general rule." This principle is not, however, as with Mill and Jevons, derived from experience, but is a postulate of our thinking.[39]

[39]Somewhat similar to Sigwart's conception is that of Ueberweg. According to him, the incomplete induction would, according to the rules of the syllogism, justify only a particular conclusion. The validity of the generalization of the conclusion rests partly upon the general assumption of a lawful causal nexus in the objects of our knowledge, partly upon the special assumption that in the given case some lawful causal nexus exists between the subject and predicate of the conclusion. The import of induction as a means of extending our knowledge rests upon the same relation to the real uniformity (according to the principle of ground) on which the possibility of the syllogism as a form of knowledge is founded. The existence of the causal nexus precedes our inductions. Our knowledge of the causal nexus in a particular case presupposes a collection of facts, and our knowledge of the causal nexus in general form follows upon many special inductions. This knowledge is the condition (not of these inductions, in which case we should have a *circulus vitiosus*, but only) of the logical justification of these inductions. We at first generalize only according to psychical laws of association; our generalizations have logical justification in so far as they invariably coincide with the objective causal nexus. *System der Logik*, §§127ff.

The same idea is very clearly brought out by Creighton in his *Introductory Logic*, §88. In induction, he tells us, we begin with particular phenomena, and try to discover from them the law or principle which unites them. Certain facts are observed to happen together, and the problem is to find the ground or explanation of this connection. Inductive inference is thus a process of reading the general law out of the particular facts. It is an insight into the nature of the whole or system, based upon the careful examination of the parts. Inference always implies an effort on part of the mind to see how phenomena are neces-

§ 6. Lotze[40] declares that "in attaining to universal propositions of the form all S are M, induction has reached its first goal, and it is possible to rest content with the result, especially when we are dealing with a question of practical life; for in such questions we can go without a reason, so long as we are certain that as a matter of fact M is really true of all instances of S, say of all men; we do not care so much to know why it holds of them, and why only of them and not perhaps of animals as well. The theoretic impulse however is not satisfied with merely joining M to its proximate subject; it would fain seek out within the limits of S the narrower group of attributes, which contains the ground of this conjunction, and which conditions the same attribute, wherever it may occur, perhaps even outside

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sarily connected according to some general principle. And in carrying out this purpose, the mind must begin with the knowledge which it already possesses. When the general law of connection is known, and the object is to discover the nature of some particular fact, the method of procedure is deductive. But when the problem by which we are confronted is to read out of the facts of sense perception the general law of their connection, the method of inference which must be employed is that of induction. But from whatever point we set out, and whatever may be the immediate object of the inference, the result is always the same—an insight into the necessary connection of facts according to some general principle. The essential point is to detect the general law or principle, and for this purpose one case may conceivably be as good as a hundred. Inductive inference, then, is not a process of passing from a certain number of cases to a general conclusion which always remains probable because it has no proper justification. But its real nature consists in the discovery, through the aid of examples, of a universal law of connection. See also, the able works of Hibben, *Inductive Logic*, and Welton, *A Manual of Logic*, volume II.

[40] *Logic*, English translation, edited by Bernard Bosanquet; *Outlines of Logic*, translated by G. T. Ladd. These translations have been used by me in the text.

S. Then the induction is pushed further; we use a series of universal propositions of the form: SM, RM, TM, . . . as our new premises and try to deduce from them an universal conclusion of the form all Σ are M. In this new conclusion we understand and denote by Σ the true subject or the conception of the genus, or, to put it in another way, that complex of attributes, on which the predicate M in all cases depends and from which it results. Thus in our first induction we shall reach the proposition SM; in all animals an exchange of gas takes place in respiration; in a second induction in which S is successively replaced by birds, fishes, and amphibia, we shall reach the conclusion ΣM, all animals require an exchange of gases. This new conclusion at once throws light on the earlier one, by showing that what we had hitherto only observed as an isolated fact is really necessitated by the universal nature of animal life; a third induction sets alongside of ΣM a new premise to the same effect, viz. all plants display though in another way the phenomenon of a change of gas; its conclusion ΣM, all organic beings whatever find themselves in like case, shows us the phenomenon in question bound up with a still more universal subject, and lastly by comparing the behavior of bodies which resemble organic bodies in structure towards the surrounding atmosphere we might be led to the thought that under the conditions prevalent on the earth's surface, such an exchange of material is absolutely necessary to the development of those interdependent processes of change, which make up organic life. In all this it is to be noticed that the further we advance these inductions the less do we care to obtain as our result a categorical judgment of the form S is P; we are no longer seeking the highest general conception, to which a given phenomenon attaches a predicate; what we are in search of is a *hypothetical* judgment,

which will acquaint us with the most general *condition* C, upon which the phenomenon always depends and of which it is the consequence wherever it occurs."[41]

"Stated in its complete logical form a law is always a *universal hypothetical judgment* which states that whenever C is or holds good, Σ is or holds good, and that whenever C undergoes a definite change into C^1 through a variation of itself, dC, E also becomes E^1 through a definite variation of itself dE which depends on dC. A law is hypothetical, because it is never meant to be a mere enumeration of what happens; its sole function is to determine what should or must happen when certain conditions are given."[42] "In theoretical investigations of reality, we mean by a law the expression of the peculiar inward relation which exists between two facts and constitutes the ground at once of their conjunction; and in every single case there is but *one* law."[43]

The logical idea upon which induction rests is by no means merely probable, but certain and irrefragable. It consists in the conviction, based upon the principle of identity, that every determinate phenomenon M can depend only upon one determinate condition, and accordingly that, where under apparently different circumstances or in different subjects P, S, T, U the same M occurs, there must inevitably be in them some common element

[41] *Logic*, vol. II, pp. 35 ff. See also, *Outlines of Logic*, pp. 72 ff., 121 ff. *Outlines*, p. 123: "That is to say, it is only rarely of much use to us to show that a P is united with a general generic concept S, and belongs to all species of S. As a rule, we desire still further to know on what *ground* P belongs to S. This, expressed in general form, leads to the problem of searching for the conditions on which the occurrence of an event depends in all the otherwise diverse instances of its repetition."

[42] *Logic*, vol. II, p. 68.

[43] *Logic*, vol. II, p. 71.

Σ, which is the true identical condition of M or the true subject of M.[44]

"It would be quite unjustifiable to object, that as a matter of experience the same consequence M is often produced by different equivalent conditions, and the same predicate M may occur in extremely different subjects. If there are two equivalent conditions for a result M, it is not in virtue of that which makes them different, P or S, but of that which is the ground of their equivalence, that they are really conditions of the same result: so long as we cannot separate this common characteristic in the two, we have not yet found the true Σ of the conclusion, and have not therefore carried out the induction in the way in which it demands to be carried out. Again, if the same M is found as predicate in a number of extremely different subjects, and subjects (as is usually the case in practice) the several sums of

[44]*Logic*, vol. II, English translation, p. 23: "The law of identity guarantees that if the same S were once more perceived in a second experience it would be impossible that the same predicate P should be absent or should be replaced by some other predicate Q." *Outlines of Logic*, p. 120: "It follows from the law of identity, that a truth which is valid once can not fail to be valid a second time; accordingly that every individual experience is once for all valid—that is to say, the same predicate is again valid at all times for all cases of the recurrence of the same subject. The difficult thing is simply to determine *in praxi* whether a second instance does actually repeat precisely the subject observed in the first case. For this the probabilities are different in different domains of research. For example, it is enough for the chemist, if he once knows that he has some element before him in a *pure* state, to observe its reaction towards some other element a single time, in order to establish it forever. The zoologist, on the contrary, will hold some peculiarity of a new animal, only one example of which has been discovered, to be 'normal,' that is, to be valid in general (since disease and malformation are possible in such a case), only when the analogies of other classes of animals justify him in this assumption."

whose marks are only partially known, we may of course make a great mistake if we combine what is common to the known marks of all of them, and then assume it to be Σ, the true subject of the mark in question M. I do not deny that in the practice of induction we are often placed in such unfavorable circumstances; but all these difficulties in carrying out the inductive principle do not alter its universal logical validity, when it asserts that wherever different conditions have the same result M, or different subjects the same predicate M, there must be discoverable one and only one determinate Σ, forming the single invariable condition or the single true subject, to which the predicate or the result M is to be universally and necessarily ascribed in a conclusion of the form, 'every Σ is M.'"[45]

That is, induction is founded on the principle that every phenomenon has its definite condition, and this condition is always the same. There is uniformity in nature, whatever has happened will happen again and will happen as it happened before.[46] Things are identical with themselves: whatever is re-

[45] *Logic*, vol. I, pp. 136f.

[46] *Logic*, vol. II, p. 25: "Once suppose that a single observed case is valid only for itself and not for its repetitions in like case * * * once suppose that with like object and like conditions a different result may be true, and there is an end to all possibility of developing universal truths from experience; there is an end not merely to the discovery of laws but to the use of the word 'law' with any intelligible meaning. The art of induction, which is to bring us to universal laws, rests wholly on the acumen shown in developing pure and self-connected propositions of the form Σ is Π out of the impure and confused material of our perceptions, which come to us in the form S is P"

mains what it is.[47] Induction is therefore ultimately based by Lotze on the principle of identity.[48].

[47]Compare this idea with the statement in *Outlines*, pp. 34f: "This simple logical meaning of the proposition [of identity A=A] must without fail be distinguished from other theorems, partly true, partly doubtful, which, although they spring from the application of the universal logical proposition of identity, still do so only from its application to a definite real content, and are not on a par with the proposition itself. For example, that every 'thing' is like itself, or that it is unchangeably like itself, is a *metaphysical* proposition which arises from an application of the logical proposition of identity to the concept of the 'existent.' The logical proposition itself says nothing at all of 'things.' It is also valid of events that happen, of conditions that take place, of the real as truly as of the unreal. And of all of them it merely says, that to be is to be, the changeable is changeable, the contradictory is contradictory, the impossible is impossible." I do not see how this thought agrees with the notion that the idea on which induction is based is certain and irrefragable.

[48]According to Kromann, *Unsre Naturerkenntniss*, all logic is based upon the law of identity. Hence induction, to be a logical process at all, must obey this law, or must be perfect, *i. e.*, as much must be contained in the premises as is contained in the conclusion. It would have the following form: This oxygen has a specific gravity of 16; all oxygen is like this with respect to its specific gravity; hence all oxygen has a specific gravity of 16. Or it may read as follows: This oxygen has a specific gravity of 16; all oxygen is probably like this with respect, etc.; hence all oxygen has probably a specific gravity of 16. The induction is based on the identity of the examined case with all other cases of the same kind. The principle of identity: the world is identical with itself, every thing is what it is, is not the result of experience, but a postulate, a primary hypothesis with which we approach the investigation of reality. It is a necessary postulate of the will to live; the acceptance of it makes life possible. See also Bosanquet, *Logic*; *Essentials of Logic*, pp. 153, 162, 165.

PART II

THE THEORY OF INDUCTION[1]

§ 1. An examination of the different theories of induction shows us that there are two questions at issue: (1) What is the nature of the process called induction? And (2), What is the validity of the process?

The first question is answered as follows: Induction is defined in a general way as a process of inferring from the particular to the universal. That is, whenever we derive a general statement from a particular statement or facts, we have induction. Most writers would be willing to accept this as a rough definition of the process. Some distinguish between scientific induction and unscientific induction, but look upon both forms as coming under the definition.[2] Others, however, reject the unscientific form, or simple enumeration, and accept only that phase of induction which derives from particular facts the law of their necessary connection. According to them, induction seeks to discover not the casual, but the causal connections.[3] Of these, some identify

[1]Read before the joint meeting of the American Psychological Association and the Western Philosophical Association, Chicago, January 1, 1902, and published in the *Philosophical Review* of July, 1903.

[2]Bacon, Mill, Veitch, Lotze, Wundt.

[3]Sigwart, Ueberweg, Bosanquet, Hibben, Welton, Creighton; Shute, *Discourse on Truth*; Hamelin, *Sur l'induction*.

induction with scientific method in general, including under it the forming of hypotheses, deducing their consequences, and verifying them.[4]

The second question also receives various answers. According to some thinkers, only so-called perfect induction is certain; imperfect induction is merely probable.[5] Nearly all seem to agree, however, that induction is grounded on the principle of the uniformity of nature. This principle is interpreted differently by different thinkers, sometimes merely called by another name. Some speak of it as the principle of identity. What is once true will always be true; whatever is, will remain so: the world is identical with itself.[6] Some express the same idea by saying that the particular is the expression of the universal.[7] Some call the principle the principle of necessary connection: the given is necessary.[8] Some identify it with the law of causation: every event must have some cause.[9]

Moreover, this principle of uniformity is conceived by some

[4]Sigwart, Jevons, Hamelin.

[5]Apelt, Whately, Jevons.

[6]Lotze, Kromann, Bosanquet.

[7]Aristotle, Hegel.

[8]Sigwart, Ueberweg, Hibben, Welton, Creighton.—Venn, *Empirical and Inductive Logic*, defines it thus: "Perhaps indeed as near an approach as we can get to any definition is reached by saying that wherever any two or more attributes are repeatedly found to be connected together, closely or remotely, in time or in space, there we have a uniformity. And the general expression, the uniformity of nature, is intended to cover all such partial connections, and to imply that their existence may be detected or reasonably inferred throughout all phenomena whatever" (p. 93).

[9]Mill, Jevons, Veitch, Benno Erdmann.

as a postulate of our thinking,[10] by others as the product of experience.[11]

§ 2. Let us now attempt to answer the first question: What is the nature of induction? Induction is a process of inference. We must be careful to distinguish between inference and association of ideas. The perception of fire may arouse in the child's consciousness the thought of a burn, simply because these two things have been experienced together before. A knock at the door may arouse in my consciousness the image of a man making certain movements. But in neither case is there necessarily inference. In order to infer, I must consciously relate one judgment with another. I must ground it on some other judgment, or draw it from some other judgment. I must say, *Because* this is so, that is so; or, this is so, *therefore* that is so. In the words of Ladd: "The thinking subject reaches genuine logical inference whenever two judgments are related in such manner that one is made the 'reason' or 'ground' of the other, with a consciousness of the relation thus established between them."[12] There are two kinds of reasoning, deduction and induction. Both are processes of inference, and therefore essentially the same, that is, both consciously relate judgments with other judgments. In both cases a certain judgment is accepted on the ground of another; this is so, we say, *because* that is so; or, this is so, *therefore* that is so. The dif-

[10]Sigwart, Lotze, Kromann, Bosanquet, Hibben, Welton, Creighton.—Venn, *Empirical Logic:* "I am very decidedly of opinion that the difficulty does not admit of any *logical* solution. It must be assumed as a postulate, so far as logic is concerned, that the belief in the Uniformity of Nature exists, and the problem of accounting for it must be relegated to Psychology" (pp. 131 f).

[11]Mill, Jevons, Benno Erdmann.

[12]*Psychology, Descriptive and Explanatory*, pp. 463 f.

ference between the processes consists in this; in induction we ground our judgment on particular instances, that is, pass from particulars to a universal proposition concerning them; while in deduction we ground our judgment on a universal proposition, that is, we start from a universal proposition and draw from it other propositions according to the principle of identity. "In induction, then, we conclude that all A is B, because we have observed that a1 and a2 (all essentially alike and capable of being grouped under A) are B. In deduction we know, or assume as known, that A is B, and conclude that a3 (which we have never met with before) is B."[13] When I infer that all swans are white, because the swans I have seen were white, I am reasoning inductively. In induction we leap from a particular case or cases to all; we infer that because a certain thing is true of a certain case or cases, it is true for all cases resembling the others.

And here it is well to remember several important points. 1. So far as the principle is concerned, it makes no difference whether the induction is true or false. It is just as much an inductive inference to conclude that all crows are black because some are, as to conclude that all men are mortal because some are. Hasty induction is induction, as much so as careful and scientific induction. The characteristic mark of induction consists in making the so-called "inductive leap," in jumping from one or more instances to a general conclusion.[14]

2. Nor is it correct to limit induction to the discovery of causal relations. Whenever we infer a universal statement from a particular case or cases, leap from the particular to the universal, we have induction. We do not strive to know merely the

[13]Ladd, *Psychology*, p. 478.

[14]"An imperfect, hasty, or unwarranted induction is still an induction, only a bad one." Veitch, *Logic*, p. 461. See also Mill, *Logic* Bk. III, chap. iv, §3 note.

causes of things; we are interested in other relations also, for instance, in the co-existence of certain qualities, whether they are causally related or not.[16] Our purpose is to discover regularity, uniformity everywhere. Of course, if we identify causality with uniformity, as some writers do, if we call all those relations causal in which there is uniformity of sequence or co-existence, then induction means to discover causality. But if we do not define causality that way, if we do not conceive all uniform sequences and co-existences as causally related, then we cannot define induction as the quest for causal relations; for, as was already said, we are interested in all kinds of regularity or orderliness. It is true that, wherever we find such regularity, we are tempted to read causality into it; but that is another story.

3. And this leads us to another point. It is held by many writers that induction seeks to discover the inner, necessary relations existing between things. In a certain sense, this is true. The thinker is always eager to find out what qualities are connected necessarily, that is, he wants to feel not only that certain qualities go together, but that they must somehow go together. He is not satisfied with the statement that all swans are white, because he does not understand the inner relation existing between swan nature and whiteness, he does not see why swans should be white, he does not see any necessary relation here. He seeks to discover connections between things which will satisfy him. "Take, for instance, the simple effect of hot water cracking glass. This is usually learnt empirically. Most people have a confused idea that hot water has a natural and inevitable tendency to break glass, and that thin glass, being more fragile than other glass, will be more easily broken by hot water. Physical science, however, gives a very clear reason for the effect

[16]See Veitch, *Logic*, p. 461; Venn, *Logic*, p. 93; Sigwart, *Logik*.

by showing that it is only one case of the general tendency of heat to expand substances. The crack is caused by the successful effort of the heated glass to expand in spite of the colder glass with which it is connected."[16] That is, the scientist aims to bring his proposition under a proposition which is more general in its scope, one which expresses a more constant connection between objects than the other, and therefore impresses us as necessary. He seeks for a simple formula under which he can embrace a great many cases that seem to have nothing at all in common. "Suppose some one observes that (*a*) the addition of fuel, (*b*) the action of blowing, and (*c*) cold weather increase the flame of the fire. He may at first be satisfied with the assumption that every one of these three phenomena is a cause of the increase of the flame. But when he discovers a great number of phenomena which are followed by an increase of flame, he finds it hard to think of them all. But if he can find that every time the flame is increased, something was added to the fire which, according to analysis, contains oxygen, he will reduce the manifold experiences to the simple formula: All things which contain oxygen and are added to fire increase the flame. He will probably go farther and say: Oxygen is the cause of the increase of the flame."[17]

The truth is, the thinker aims to understand his facts, that is, to assimilate them to the known, to bring them into relation with what he already knows. You tell him that heat cracks the glass because heat is motion, expansive motion; he understands that because he has seen many examples of motion breaking things. "We did not reject the assertion that there are black swans," says Mill, "while we should refuse credence to any

[16]Jevons, *Lessons in Logic*, p. 257.

[17]Uphues, *Grundlegung der Logik; Nach Shute's* Discourse on Truth *bearbeitet*, p. 182.

testimony which asserted that there were men wearing their heads underneath their shoulders. The first assertion was more credible than the latter. But why more credible? So long as neither phenomenon had actually been witnessed, what reason was there for finding the one harder to be believed than the other? Apparently because there is less constancy in the colors of animals than in the general structure of their anatomy. But how do we know this? Doubtless, from experience. Experience testifies that among the uniformities which it exhibits or seems to exhibit, some are more to be relied upon than others."[18] But it must not be forgotten here that it is induction to conclude from our observations that heat cracks glass, that blowing makes the fire burn, that chlorine bleaches, even if we do not understand the reasons or see the so-called necessary connections. "We learn empirically that a certain strong yellow color at sunset, or an unusual clearness in the air, portends rain; that a quick pulse indicates fever; that horned animals are always ruminants; that quinine affects beneficially the nervous system and the health of the body generally; that strychnine has a terrible effect of the opposite nature; all these are known to be true by repeated observation, but we can give no other reason for their being true, that is, we cannot bring them into harmony with any other scientific facts; nor could we at all have deduced them or anticipated them on the ground of previous knowledge."[19] Induction is induction, whether we can bring it into harmony with other scientific facts or not. It must further be remembered that deduction frequently enters into those cases in which we reach so-called necessary connections. I discover by induction that heat cracks glass. I refer this empirical law to a larger induction, that heat expands substances. I say heat must crack glass under certain

[18] *Logic*, Bk. III, ch. iv. See also ch. iii.

[19] Jevons, *Lessons*, p. 256.

circumstances, *because* heat expands substances. If heat expands substances, it must expand glass; and if the colder parts of the glass connected with the heated parts do not expand fast enough, the glass will break. This is really deduction. I subsume the case under a general rule. I think I understand it better when I see that it is really an instance of a general occurrence with which I am very familiar.

4. This brings us to another point. Several thinkers define induction as forming hypotheses, drawing their consequences, and verifying them. This, it seems to me, is a false definition. If we define it in this way, then we apply the name induction to different operations, we include under it both induction and deduction. If induction is both induction and deduction, then what is the process called induction, which with deduction constitutes induction? Of course, we may, if we choose, apply the term induction to scientific methods in general, to the method which everybody uses in the pursuit of truth, and which embraces all the operations of the mind that lead to truth. But in that case what is the process called induction proper? And why should we use one term for two processes, first for a combination of induction and deduction, then for induction itself? The logical thing to do is to restrict the term induction to induction proper, to the process of inferring a general truth from particular instances, and to use another name for the combination of this process with deduction. In his smaller book Jevons calls this method, which he designates as induction in his *Principles of Science,* the combined or complete method. "What Mr. Mill has called the deductive method, but which I think might more appropriately be called the combined or complete method, consists in the alternate use of induction and deduction. It may be said to have three steps, as follows:—(1) Direct induction; (2) Deduction, or, as Mr. Mill calls it, ratiocination; (3)

Verification. The first process consists in such a rough and simple appeal to experience as may give us a glimpse of the laws which operate, without being sufficient to establish their truth. Assuming them as provisionally true, we then proceed to argue to their effects in other cases, and a further appeal to experience either verifies or negatives the truth of the laws assumed." [20]

5. There is another point to be observed. It is held that when I infer from one or more cases to all like them, I base myself either consciously or unconsciously on the principle of the uniformity of nature. That is, I reason thus: This is true of these cases; what is true of some cases is true of all like them; hence this is true of all. In other words, induction is really deduction. This, however, does not seem to me to be the case. In fact, the statement that what is true in some cases is true in every case like them, is the very thing that is inferred in induction. We infer that this will always happen because it has happened. As soon as we observe the co-existence or sequence of certain qualities several times, we naturally draw our conclusion, we make the inductive leap. We say, *sometimes*, hence, *always*. Why we do so, it is impossible to say; it is one of those inexplicable facts, a natural function of the human mind, a way we have of thinking, that is all. We expect repetition. We may have no right to expect it, but the fact remains that we do expect it and conclude that it will come. We infer when we find a ground or reason for our proposition. Everything is a ground for us that really satisfies us. Closer thinking may destroy our satisfaction, but so long as we have grounded our proposition upon some other proposition and are satisfied, we have reasoned. We may have reasoned wrong, but we have reasoned. Inductive inference is a function of the mind aroused by the experience of recurrence, in which we regard the par-

[20] *Lessons in Logic*, pp. 258 f. Compare page 14 of this paper.

ticular as a type, as having universal significance. It is frequently hasty and its results are frequently discovered to be false, but that does not affect its nature. The point to be emphasized here is that induction consists in making the leap spoken of, regardless of whether we have any warrant for doing so or not. We say, what is true of these particular instances is true of their class, and, after having made many such inferences, we finally reach the belief that nature at large is uniform. The belief in the general uniformity of nature is a late product in the history of civilization, and is not even universally accepted to-day. It is preceded by, and grows out of, the belief that a particular instance will repeat itself.

§ 3. This brings us to our second fundamental question: What is the validity of the process of induction? What is its warrant? Here we may discuss two problems. (*a*) How can we reach the greatest possible certainty in particular inductions? (*b*) How can we prove induction in general?

(*a*) Certainty is a feeling. We feel certain that a proposition is true; the proposition is certain because it arouses in us the feeling of certainty. What must we do to reach such certainty in a particular induction? We increase our feeling of certainty in many ways. We notice that qualities go together. The more often we observe it, the more certain we feel that they will continue to go together. When we observe that one fails to appear the other fails to appear also, and that when one varies the other varies, we feel still more certain that they go together, that our induction is true. The purpose of the so-called inductive methods is to bring this certainty to the highest possible degree. We feel most certain of propositions which have been verified countless times, and of which we have experienced no contradictory instances. It is for this reason that we strive to

subsume all other propositions under such propositions, that we try to consider them as instances of these. We have had a great deal of experience with motion, for example; hence, if we can reduce a phenomenon to motion, we feel that we know something about it. In other words, we reach the greatest possible certainty for our particular inductions when we subsume them under generally accepted principles, or *prove them deductively.* That is why sciences become more and more deductive in the course of time.

It is also to be noted here that, wherever the connection is believed to be a causal connection, one case is as good as a thousand. When I believe that two phenomena are causally related, I am sure that one will always follow the other, because causal connection means a necessary connection, because the notion of cause implies that when one phenomenon appears the other must somehow appear also. When I conceive of a particular case as a case of causality, when I say in this particular case *a* was the cause of *b*, I do not need any other cases to convince me that there is a universal relation. I conclude from one to many, because I have already assumed uniformity by assuming causality. Similarly, whenever I conceive of phenomena as necessarily related in any other way, one case is as good as a thousand. When I see that the sum of the angles of a triangle is equal to two right angles, having proved it for a particular triangle by showing that it follows necessarily from the definition of a triangle, then I am satisfied that it will be true of all triangles; and there is no need of my examining any more.

These cases, however, are not cases of induction. When I say, this phenomenon caused that one in this particular case, therefore whenever I have this phenomenon in other cases I will have the other also, I am reasoning *deductively.* By saying that a particular relation is a causal relation, I am implying that it has

universal validity. I reason: If *a* and *b* are causally related, then when *a* appears *b* will appear also. Now *a* and *b* are causally related. Hence, when *a* appears, *b* will appear also. This is deduction.

(*b*) How can we *prove* induction? By proof we mean deduction. Our question therefore means: What must we do in order to deduce a conclusion which has already been derived inductively? In deduction we consciously draw a proposition from premises in which it is already implied; we explicate it. Here our conclusion will give us a feeling of absolute certainty, that is, we will feel that if the premises are true, the conclusion must be true, unless we have made a mistake in our reasoning. It is not difficult to construct a syllogism in which the inductive proposition forms the conclusion. For example, if it is true that nature is uniform, that nature repeats itself, that it is a reign of law, then we have a proof for induction. One should remember, however, that this does not make induction deduction. Induction is induction; by *proving* a proposition that has been derived inductively, we do not make induction deduction, we simply apply another process, deduction, to a proposition that has already been derived inductively. The process of *proving* the inductive proposition is not induction, but deduction. Here the certainty of the proof will, as always, depend upon the certainty of the principle of uniformity. The more we believe in this principle, the more certain we shall be of our inductions, the more satisfied we shall be with them.

Induction, therefore, may be proved by assuming the law of uniformity. We are warranted in leaping from part to whole by the regularity, or orderliness, or uniformity of nature. If it is true that nature is uniform, that nature repeats itself, we have the right to conclude from a few instances to all like them. The only problem here is to discover the particular combinations, the co-existences and sequences in nature.

But the question at once arises: What warrant have we for saying that nature *is* uniform? It may perhaps be said that this principle is a postulate of thought, and that it carries its warrant in itself. We cannot prove its truth, but we feel certain that it is true; we accept it without cavil. But is it really a postulate of thought? Does everybody really accept it? Does it inhere so in the nature of our thought that we must accept it?

That depends entirely upon what we mean by it. If we mean by it the clearly conscious thought that nature at large, internal and external nature, is governed by law, that it is a unified system, then we cannot regard the principle as a postulate of thought. In this sense, it is plainly a product of development, the result of much reflection upon the world, and even then not at all universally accepted. There are many persons who will not admit that external nature is a closed system, exempt from interference, and there are still more who will not admit that the mental realm is subject to law. Interpreted in the above sense, the principle of uniformity must be regarded as the result of reflection upon our experiences. We have noticed many particular uniformities; we conclude that nature at large is uniform, that is, we consciously ground our proposition upon our past experiences. In this sense, the principle of uniformity is an induction: Because there are uniformities, there is uniformity. And if we try to base the inductive process upon the principle thus understood, we are really reasoning in a circle, as has been so often pointed out. We prove the uniformities by the uniformity, and the uniformity by the uniformities. We say we are warranted in inferring from the particular to the universal, because nature repeats itself, because nature is uniform; and we say we know nature is uniform, because we discover particular uniformities and conclude from these that there is general uniformity.

We may, however, mean by the principle of uniformity of

nature as a postulate of thought, not a clear conviction that nature as a whole is a unified system, subject to law, but the feeling in every particular case that this particular experience, will come again. Here we form no conception of nature as a whole; but every time we have a particular experience, we expect it to recur. After having a particular experience a number of times, we feel that it will come again, we expect particular things to repeat themselves. Our feeling of expectation here may be called a postulate of thought, and it becomes the psychological ground of our inductive inference. That is, there is no reason for *inferring* that a particular co-existence or sequence of qualities will recur except the *expectation* that it will recur. We feel that what happens in this particular case will happen so again, we *expect* it to happen so again; we therefore *infer* or *conclude* that, because it happened once, it will happen again. That is, I have no other warrant for inferring that a combination of qualities will recur than the feeling of expectation that it will do so.

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Sometime Fellow in Zoology

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DEPARTMENT OF ZOÖLOGY

A DISSERTATION SUBMITTED TO THE FACULTY OF THE GRADUATE DEPARTMENT OF THE UNIVERSITY OF MISSOURI, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS.

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REGENERATION OF CRAYFISH APPENDAGES.

INTRODUCTION.

The results embodied in this paper were obtained from experiments carried on continuously from October, 1896, to June, 1901. The work was begun under the direction of Professor Howard Ayers in the Zoölogical Laboratory of the University of Missouri, and was completed under Professor George Lefevre.

I am indebted to Professor Ayers for direction and advice during the first three years of the investigation, and to Professor Lefevre for many valuable suggestions afterwards. I also wish to express my appreciation of assistance given me by Professor E. G. Conklin, of the University of Pennsylvania, in making making certain revisions of the work, and by Dr. Charles Thom and Dr. C. M. Jackson in the preparation of material.

NOTE: The publication of the present paper, practically completed in 1901, was at first postponed in order to incorporate in it the results of certain experiments which were at that time still in progress. Since the conclusion of these experiments, circumstances which have been unavoidable have unfortunately made it necessary to further delay the final appearance of the paper. GEORGE LEFEVRE.

I. HISTORICAL SUMMARY.

Regeneration in Crustacea, esecially in the Decapoda, has been the subject of casual and experimental observation for more than two hundred years. Du Tertre's observations (1654) on the crabs of Guadaloupe are the earliest recorded. Although the subject dates back far beyond the beginnings of modern biological science, yet comparatively little work has been done, and our knowledge, beyond the fact that regeneration of lost parts does take place, is still meagre. Du Tertre's observations were merely casual and not at all extended. Regeneration of parts in Crustacea has, however, been studied by Réaumur (1712), Goodsir ('44), Chantran ('73), Brooks ('87), Herrick ('95), Herbst ('96, '99, 1901), and Morgan ('98, 1900).

Réaumur's observations were made upon crayfish, crabs and lobsters, and his general account of the regenerative process in crayfish is especially noteworthy. Réaumur began his experiments at the seacoast upon crabs and lobsters, but the sea either carried away his boxes or filled them with sand, and he then used crayfish with greater success. The following is quoted by Herrick ('95, p. 103), from Réamur's account of his experiments upon crayfish: "I took several of them from which I broke off a leg; placed them in one of the covered boats, which the fishermen call 'boutiques,' in which they keep fish alive. As I did not allow them any food I had reason to suppose that a reproduction would occur in them like that which I had attempted to prove. My expectation was not in vain. At the end of some months I saw, and this without surprise, since I had expected it—I saw, I say, new legs which took the place of the old ones which I had removed; except in size they were exactly like them; they had the same form in all their parts, the same joints, the same movement." Evidently Réaumur is describing

the regenerated appendage after a moult has taken place, for previous to a moult new legs are not exactly like the old ones "except in size;" constrictions merely appear in the place of true joints, and the movements are far from similar to those of a normal leg. It is difficult to understand what difference he expected to find by not feeding the crayfish, for the only probable effect would be to retard the regeneration.

Réaumur also noticed that the length of time required for the production of new appendages was dependent upon a number of conditions. The growth was more rapid in warm than in cold seasons, and when the legs were broken off in winter they did not grow again until summer. He also cut off the "tails" of crayfish, but states that no regeneration took place and that the animals invariably died a few days after the operation. His attempt to explain the regenerative process is one of the earliest explanations offered. He supposed that scattered throughout the limbs are little "eggs" containing the germs of parts of new limbs and that when an appendage is broken off the juices which go to nourish this limb are then directed to the development of the "eggs" containing parts of new limbs. He saw that before such an explanation would be adequate there would have to be more than one "egg" of the same kind, for a regenerated leg can be broken off and another one regenerated in its place. In fact the process can be repeated a number of times, and obviously there would have to be reserve germs for an indefinite number of regenerations. Such an explanation immediately reminds one of Bonnet's theory (1770) of head and tail stuffs and their influence upon germs, except that Bonnet did not suppose specifically different germs at every level. Compare also Weismann's doctrine of determinants.

Chantran ('71) in the study of the growth and development of crayfish incidentally made some observations upon

regeneration. He says that the antennae are regenerated between two successive moults but that other appendages must pass through three moults in order to be regenerated. In a later paper ('73) he gives an account of his experiments upon the eyes of crayfish. He finds that when a part of the eye is removed regeneration takes place more or less rapidly according to the age of the individual and the season of the year. When the eyes are cut off in October at the close of the moulting season no new growth is apparent until the following May. When the whole eye is excised no regeneration takes place.

Goodsir ('80) gives a short account of the regeneration of lost parts in Crustacea, and attempts an explanation of the process, which, however, is not in accordance with results obtained by other observers.

Brooks ('87) confined his observations to the common lobster (*Homarus vulgaris*). His paper is not at hand and I have but a very meagre account of it. Herrick ('95, p. 105) mentions some of Brooks' results. They agree with similar observations made by Herrick himself upon the regenerative processes in the lobster.

Herrick ('95, pp. 104-108) gives a very concise account of his observations upon the regeneration of the chelipeds, antennae and some of the periopods of the lobster. He, too, has noticed that the rate at which regeneration takes place varies greatly with the season of the year, the age of the individual, and whether or not the loss of a limb occurs a short time before or a short time after a moult. In the larvae of lobsters the process of regeneration is very rapid. One case is mentioned in which the cheliped was entirely regenerated within fifteen days. Two moults had occurred, however, during this time. In another case there was complete regeneration after a single moult. But, on the other hand, it may require as long as a month for a young lobster to completely regenerate a lost appendage.

Herrick says that, although so far as known, autotomy does not occur in the antennae, regeneration may take place at any articulation in the flagellum or the stalk. In the young lobster the flagellum of the second antennae may be completely restored without an intervening moult, but in adult individuals one moult at least seems necessary for complete restoration. The internal changes, which do not differ from those observed in crayfish, will be referred to in the discussion of the same phenomena there.

The next experimenter upon regeneration in Crustacea was Herbst. As material for experiment he has used Decapods of at least three different families and two genera of Isopods. His experiments have included the removal of both the whole and a portion of the eye, and have extended over the past five or six years. The first series of experiments was confined to the shrimp, Palaemon ('95), and was primarily undertaken for the purpose of determining whether presence or absence of light has any influence upon regeneration of the eyes. The whole of one or both of the eyes was removed, in most cases only one, for the removal of both eyes was attended with such excessive bleeding that it usually resulted in the almost immediate death of the animal. The experiments were begun in October, but not until the following March was any regeneration apparent. When at last the regenerated structure did appear, it was an antenna-like organ, not an eye. Herbst speaks of these structures as "*antennenähnlichen-Organen.*" They are not alike for all individuals but exhibit two general types, the first, a short horn-like process consisting of at most two segments, and the second, a longer, segmented out-growth resembling the flagellum of an antenna. On the short horn-like processes long segmented setae or hairs were conspicuous, and these Herbst regards as sensory (l. c., p. 507, Figs. 2 and 6). The long an-

tenna-like structures may be subdivided into two classes: in the first a flagellum arises from the distal end of a larger basal portion which resembles the horn-like process of the first type; and in the second a flagellum proceeds, not from the distal end of the basal horn-like portion, but from its side, thus forming a forked structure borne on a common base. The flagellum is not beset with long hairs as in the shorter process, but on the distal borders of the segments are tufts of setae similar to the setae found on the flagella of the antennules. Presence or absence of light had no apparent effect upon the character of regeneration, although a much larger percentage of the individuals kept in the dark than of those kept in the light showed regenerative power.

Sicyonia sculpta ('96), a member of the same family as *Palaemon,* furnished material for the second series of experiments. These were also confined to the total excision of the eye, and the observations are recorded with much greater precision in this case than in the first. Most of the animals operated upon were about four and a half centimetres in length. The mortality resulting from the operation was not as great as in the cast of *Palaemon,* but the animals were very much harder to feed, and often refused food for days at a time. They were, consequently, less favorable for experiment, and of 85 individuals operated upon during the latter part of October, on the sixteenth of the following April only 6 were living. No signs of regeneration were apparent before the last of January, even though a moult had taken place. Two, three, or perhaps four moults were found to be necessary before any definite structure appeared. Among those that lived until April, only one showed no regeneration whatever. The structures regenerated by *Sicyonia* resembled closely those already described for *Palaemon.* However, in the case of *Sicyonia,* Herbst comes to the conclusion that the antenna-like organs resemble the antennules, first antennae, more nearly than the second antennae.

Decapods belonging to several different genera, to different families even, were used in the third series of experiments ('99), but in all cases the results were similar to those obtained in the previous experiments. But in this latter investigation, the observations extended over a much greater period of time than in the previous ones, and consequently a number of details were brought out here that had not been observed before; for example, Herbst found that the regenerated structure increased in length and in number of segments as the length of time and number of moults increased; and also that the number of rows of sensory hairs, born by the flagella, became more numerous, one case being recorded in which the number of rows of hairs increased between two successive moults from 21 to 33. Several instances are mentioned in which the flagellum was 2.5 to 3 cm. in length and consisted of 110 to 150 segments. Herbst also determined the regenerative capacity of the heteromorphic structure, and found that after removal of either the whole or a part of it a similar structure was again regenerated.

At the close of the third series of experiments, there is given a *résumé* of the chief facts observed up to this time. The main points brought out are as follows: "Experiments upon *Palaemon squilla, P. rectirostris* and *P. serratus, Palaemonetes varians, Sicyonia sculpta, Astacus fluviatilis, Palinurus vulgaris, Scyllarus arctus,* and *Eupagurus psideauxii* show that after total excision of the eye, an eye is never regenerated, but instead, whenever regeneration takes place, there appears a heteromorphic structure which always resembles more or less an antenna. Some portion of this regenerated structure is always provided with long sensory hairs which, in some instances, are developed on both the basal and the distal regions." A point worthy of attention in the consideration of these experiments is the diversity of forms that were used as material for experiment. Individuals belonging to three widely distinct families were used and still the results were in the main identical.

The fourth series of experiments ('99), deals chiefly with results obtained after removal of only a portion of the eye of the stalked-eyed Decapods, *Palaemon* and *Palinurus,* and the entire eye of the sessile-eyed *Porcellana.* The experiments, however, also included the removal of the eyes of the Isopods, *Idothea tricuspidata* and *Sphaeroma serratum,* and *Palinurus vulgaris* and several species of *Palaemon* were used in the removal of only a part of the eye. The cuts removing a part of the eye were made at various angles and at different levels, but in all cases the whole or greater part of the eye-stalk was spared. Results of these experiments differed from previous results in that the regenerated structure resembled not an antenna but an eye, not exactly normal to be sure, but showing a regeneration of pigment and, in some instances at least, the suggestion of ommatidia. *Porcellana,* after total excision of the eye, regenerated not an antenna-like structure but an eye, and indeed in this case the regenerated eye seems to approach very closely to the normal one. The Isopods, *Sphaeroma serratum* and *Idothea tricuspidata,* after the removal of the entire eye, also regenerated eyes.

The results obtained from all of his experiments led Herbst to the following conclusions: first, the presence or absence of the optic ganglion determines whether an eye or an antenna-like organ shall be regenerated; second, when the optic ganglion is present an eye is regenerated; third, removal of the optic ganglion causes an antenna-like organ to be regenerated in place of an eye. In support of the second conclusion is the fact that *Porcellana, Idothea* and *Sphaeroma* regenerate eyes, although the entire eye has been removed. In these sessile-eyed forms, however, the optic ganglion is directly connected with the brain and consequently is not injured even when the eye is wholly removed. Further evidence in favor of this conclusion lies in the fact that in stalked-eyed forms the eye is regenerated after re-

moval of only the upper portion, in which case the optic ganglion has been but little or not at all injured. On the other hand, in support of the third conclusion, is the fact that, after removal of the eye, together with the stalk, and consequently of the entire optic ganglion, the only structure ever regenerated is antenna-like.

Morgan ('98), has made a study of regeneration in the hermit crab, *Eupagurus*. His experiments were made in order to determine whether or not any relation exists between power of regeneration and liability to injury. He first estimated the percentage of appendages lost under natural conditions and then carried on a series of experiments upon the different appendages, both those that were frequently injured and those that were seldom, if ever, injured. The results of his experiments led him to the conclusion that the power of regeneration and the liability to injury are in no way correlated and are not causally connected.

In a second paper, Morgan (:00) deals with the same subject. The hermit crab was again used as material for experiment and the results obtained seem to prove beyond a doubt that, for the hermit crab at least, no relation whatever exists between liability to injury and power of regeneration. It is well known that in cases of autotomy the break occurs between the second and third joints, i. e., between the basipodite and ischiopodite, using Huxley's nomenclature. Normally, of course, regeneration takes place from this point, but he found, however, that regeneration might take place not only at the breaking joint, but also at a joint either proximal or distal to it, and not only at a joint, but also from a cut surface between two joints.

Morgan ('98) also experimented upon the eyes of the hermit crab. When the entire eye was removed, his results were the same as those obtained by Herbst in the similar case. On the other hand, when only a part of the eye is cut off, an eye and not a heteromorphic structure is regenerated.

The general discussion of the theoretical considerations and the criticism of the above-mentioned experiments, together with a consideration of their relation to the results of my own experiments, are to be found in the latter part of this paper.

II. METHODS.

In the fall of 1896, I began a series of experiments and observations upon the regeneration of crayfish of the genus *Cambarus*. Two species were used, *C. virilis* and *C. gracilis*, and since the beginning of my experiments I have continually kept crayfish under observation. Great difficulty has been experienced, however, in keeping the animals alive until the completion of the process of regeneration, and this has, in some degree, interfered with the entire success of individual experiments. After many trials I finally devised, if not an entirely, at least a fairly satisfactory method of taking care of them. Before any definite and conclusive results can be obtained it is necessary that the crayfish should pass through at least one or two moults, for otherwise an appendage is never completely regenerated. Very often the crayfish dies in the act of moulting, or, if it lives through the process, dies soon afterwards.

When I first began the experiments, I kept several crayfish in the same compartment, fed them nearly every day and also changed the water on them daily, never allowing the water to completely cover them. I learned by experience that I could neither keep several together nor feed them each day. When several were placed in the same dish the larger ones would sooner or later eat the smaller ones, or when one moulted it was almost certain to be attacked in its helpless condition and devoured. There were several disadvantages in isolating individual animals, and I therefore tried different schemes for keeping them together. At first they were put into a large wire cage

placed in a pond, as there the conditions were as nearly normal as possible. This method proved unsatisfactory, however, for even when the cage was left undisturbed by intruders, as was not always the case, I had no means of keeping a record of individual crayfish. Keeping them in standing water in the laboratory was attended by one especially objectionable result. A sediment, and in some cases, a fungus growth, appeared all over the animals. I tried various means of removing this, which was particularly troublesome about the eyes, the antennae and the bases of the legs, but the only practicable method was to give them occasionally a thorough scrubbing with a rather stiff brush. Care has to be taken not to break off their legs in this operation. It was practically impossible to keep them in running water, as individual crayfish had to be placed in separate dishes. But the presence of sand or gravel in the vessels seemed to make conditions a little better, although it increased the difficulty of feeding the crayfish.

As was mentioned above, I at first tried feeding them every day, but at last learned that they thrived much better if fed only once or twice a week.

The method I now use is to keep each one in a separate glass dish, with or without gravel in the bottom; nearly cover them with water, changing it every other day, sometimes every day; feed them once or twice a week with fresh meat, occasionally with bread. They are especially fond of fresh liver and of crayfish flesh. The method is not altogether satisfactory, but it yields a fair degree of success.

I further found that the success of an experiment also depended greatly upon the time of year at which the crayfish were operated upon. Those operated upon during the fall and winter seldom live through a moult and often do not moult at the usual season. Apparently their inactivity in the laboratory is not conducive to good health, and since the moult probably does

not occur unless the animal is in its normal physiological condition, few of them are hardy enough to be kept all winter in confinement and still retain sufficient vitality to undergo a moult. My most favorable results, especially in removing the entire eye, have been obtained when crayfish were used soon after having been brought into the laboratory during March and April. These usually moulted within a few weeks and in some cases showed a surprisingly rapid regeneration.

III. OBSERVATIONS.

In my observations and experiments especial attention has been given to the regeneration of the chelipeds, antennae, tail-fins, and the eyes, although experiments upon the ambulatory appendages, swimmerets, gills, and exoskeleton have been carried on to some extent. The greatest part of my observations have been confined to the eyes, but the discussion of the regeneration of these organs will be reserved until the end.

I. CHELIPEDS.

It is well known that crayfish in common with other Decapods practice autotomy, in case of the great chelae at least. The break occurs normally between the basipodite and ischiopodite, i. e., between the second and third segments. The cheliped at this point is very much flattened and there is no movable joint between basipodite and ischiopodite. Apparently a thin cuticular partition is stretched across the appendage at this point and when the limb is broken off this membrane closes the end of the stump and prevents serious bleeding. A clot of blood soon forms and in a short time the membrane turns brown and becomes more or less hardened. The length of time which expires before the bud of a new limb appears depends upon a variety of conditions, such as the time of year, the age of the crayfish, whether or not the break occurs a short time after or a short time before a moult, and upon other conditions both internal and

external. If the crayfish is old and the break does not occur at or a short time after a moult, the new appendage is not likely to appear until after the next moult. In a young crayfish the new limb may appear whether there has been a recent moult or not.

As has been described by Herrick ('95, p. 164) for the lobster, the first external indication of a new appendage is the appearance of a small white papilla on the end of the old stump. The bud is at first semi-transparent white, and, as it grows, constrictions appear which indicate the future joints. There are at first three transverse constrictions, and then on the most distally constricted portion there appears a longitudinal fissure which marks the separation into dactylopodite and propodite. Figs. 1-4, Pl. I, show the appearance of the papilla and its subsequent transformations up to the time of a moult. Fig. 1 shows the stump before the papilla appears; Fig. 2 its first appearance; Fig. 3 the rudiments of four new segments formed, and in Fig. 4 all five new segments are constricted off. After the papilla once appears, if conditions are favorable, the subsequent growth is rather rapid, at least until the confining cuticle has reached the limit of its extensibility. As the limb-rudiment grows it changes color from a somewhat opaque white to a rather translucent white, then to pink, and finally to bright red. Usually all of the constrictions which mark the future segments of the appendages have appeared before the regenerated portion turns red. The cuticle which covers the limb-rudiment soon reaches its limit of extensibility, and no further external increase in size is apparent until after the next moult. The regenerated appendage does not then exceed half an inch in length, but inside the confining cuticle a very much greater growth has taken place, as is manifest as soon as a moult occurs. How great a growth may be compressed within the cuticle is shown by a comparison of Figs. 5 and 6, Pl. II. Fig. 5 shows the old shell

which the crayfish of Fig 6 has just discarded. The right chela, left in the figure, had been broken off and had formed the new growth indicated in the figure at *a*. When the moult took place and the new chela was released from its confining shell, the appendage expanded to the size and proportions shown at *a*, Fig. 6. At the same time it might be well to call attention to some of the other appendages that had been broken off. The first right ambulatory appendage (Fig. 5, *b*) had been broken off between the ischiopodite and the meros. The injury had taken place only a short time before, and, therefore, practically no new growth had appeared, as is shown at *b*, in Fig. 6. Fig. 5 shows a new growth (*c*), which had not yet been constricted into segments; but that segments had been formed inside the integument is seen by reference to Fig 6 (*c*). There the regenerated appendage shows the complete number of segments fully formed and perfectly normal except in size. The left leg of the same pair has made a no less remarkable growth; compare *c* (Fig. 5) and *c* (Fig. 6). The left chela was broken off during the moult. A comparison of Figs. 7 and 8, Pl. II, also shows very clearly that a considerable new growth is confined within the cuticle. Both chelae (Fig. 7) have been regenerated and show that the new growth (*a*) is of sufficiently long standing for the constrictions of the new segments to have been definitely formed. The first pair of legs have also been regenerated and four of the five new segments are apparent externally. In the moulted appendage, however, all five segments are present, *b* (Fig. 8). Practically the same state of affairs may be seen from a comparison of *c*, *d*, and *f* (Fig. 7), and *c*, *d*, and *f* (Fig. 8), except that in *c* (Fig. 8) the terminal segment of the new appendage seems to have been broken off at the last moult.

As has been previously mentioned, the length of time which elapses between the loss of an appendage and the appearance of a new one varies greatly in different individuals, and is depend-

ent, in part at least, upon the time of year and the age of the individual.

The following table gives the record of a number of crayfish, none of which exceeds three inches in length, the majority of them being smaller. It can be seen from the table that the time required for regeneration is extremely variable, in some cases all five new segments developing in less time than is required for the appearance of the papilla in other cases.

No.	Appendage removed.	Date.	Regeneration.	Date.	Regeneration.	Date.	Number of days
1	Chela	Mar. 15	Papilla appeared.	Mar. 22	.....	.....	7 days.....
2	Chela	Apr. 29	.....	.....	Five new segs...	May 6..	7 days... ....
3	Chela	May 19	.....	.....	Five new segs...	June 12	23 days.....
4	Chela	May 19	.....	.....	Five new segs...	June 12	23 days.....
5	Chela	June 7	Papilla appeared.	June 14	.....	.....	7 days .....
6	Chela	June 7	Papilla appeared.	June 14	.....	.....	7 days.....
7	Chela	June 12	Papilla appeared.	June 17	.....	.....	5 days.....
8	Chela	June 12	4 new segments..	June 19	Five new segs...	June 21	7 and 3 days..
9	Chela	June 12	2 new segments..	June 19	Five new segs...	June 21	7 and 3 days .
10	Chela	Apr. 14	Papilla appeared	Apr. 21	Five new segs...	Apr. 26	7 and 5 days..
11	Chela	Apr. 14	Papilla appeared	Apr. 22	Three new segs..	Apr. 26	8 and 5 days..
12	Chela	Apr. 14	Papilla appeared	Apr. 22	Three new segs..	Apr. 26	8 and 5 days..
13	Chela	Oct. 16	Papilla appeared	.....	Four new segs...	Nov. 16	31 days.....

In No. 2 the chela was broken off in the process of moulting and it will be noticed that regeneration took place very rapidly in this case. The five new segments were formed within a week. In No. 3 the time required to produce the same regeneration was three weeks. Of course a part of this difference may have been due to a difference in the physiological condition of the two animals, but there is no doubt that the fact that the one had just moulted while the other had not is one of the most important factors in the question. In Nos. 10, 11, and 12 a chela was removed at the same time, and No. 10 had moulted a few days before. The papilla appeared a day earlier in the latter case than in the other two, and the growth was more rapid afterwards. After the papilla once appears, it is difficult to see why the growth should not proceed as rapidly in one case as in the other. The difference must be due to physiological causes.

On October 16, 1896, a large crayfish was obtained from

which one chela was missing. The crayfish was kept in the laboratory through the entire winter and spring. On June 9, 1897, it died without having moulted since its capture. Up to this time a new chela had not appeared, but as soon as the animal died the cuticle stretched across the stump was dissected away and immediately there burst forth a regenerated chela in which at least four new segments had been formed (Figs. 9-10, Pl. I.). Fig. 9 shows the old basipodite together with the regenerated portion immediately after the cutting away of the cuticle that kept it so long from appearing. These parts are abnormal in shape and proportion, owing to the very close quarters in which they had been confined. Although the new growth was formed entirely within the old stump, it was covered with a cuticle similar to the covering of a new appendage which appears in the normal manner. In Fig. 10 the structure is seen from the opposite side, after further dissection and after the specimen had been in alcohol over night. That the new growth had been formed for some time was evident from the color, if the color of an appendage which develops normally can be taken as a criterion, for, as was previously mentioned, after a new appendage is old enough to show all the new segments, it changes from white to pink and finally to bright red. Fig. 11 shows a longitudinal section of this rudimentary appendage. Compare general outline with Fig. 10. Around the edges can be seen the cuticle (*cu*), and just beneath this lie numerous nuclei (*a*) and developing muscle fibres which radiate towards the central part of the section. Throughout the limb there is a delicate network of fibres beset with nuclei. The ground substance consists of a non-cellular, granular material, the coagulated plasma (*g*). No well-defined blood channels are present. At *p* a well-marked band of muscle fibres extends nearly across the segment. This perhaps marks the constriction between two segments. At *e* a constriction is present and a band of muscle fibres extends almost to the opposite side. There is very little reason to doubt

that this also marks a constriction where a joint would have been formed. The cleft at the distal end is a very good indication of the separation of propodite and dactylopodite. The distortion which the appendage naturally suffered from its close quarters makes it very difficult to distinguish the different segments, yet the usual differentiation of tissues has taken place, as can readily be seen by reference to Fig. 11, Pl. I. And at any rate, Figs. 9-11, Pl. I, are sufficient to show that, although no regeneration is apparent externally, this is no proof at all that regeneration has not taken place. Fig. 12, Pl. II, shows a part of the tissue from the region *a* (Fig. 11) highly magnified. This tissue consists of broad granular fibers with large nuclei. In Fig. 13, Pl. II, tissue from the region *e* (Fig. 11) is represented. Here the fibres are more definitely formed, and between the two bands of fibres, *m* and *n*, lies a space filled with coagulated plasma.

Little more need be added in regard to regeneration of the ambulatory appendages. The process is essentially the same in them as in the chelipeds, except that very often the regenerating appendage is longer in appearing than in the case of the chelipeds. This, however, does not always hold true, for sometimes the papilla appears within three or four days after the break occurs.

2. TAIL-FINS.

It was formerly supposed that the sixth pair of abdominal appendages which, with the telson, make up the tail-fin, does not regenerate when removed. Herrick ('95, p. 104) mentions that lobsters are sometimes caught in which the tail-fin and even one or two of the posterior abdominal segments are missing. None of these lobsters ever show any signs of regeneration. Morgan ('98, p. 294), however, finds that in the hermit crab the sixth abdominal appendages do regenerate.

In my experiments upon these appendages in the crayfish I have not been very successful. In several cases individuals experimented upon did not live long enough to show any signs of regeneration. However, among specimens brought into the laboratory I have found several regenerating these appendages. On November 21, 1898, I obtained an individual which had lost the entire left, sixth abdominal appendage, but at the time I found the crayfish, regeneration seemed to have advanced as far as would be expected before a moult. The moult took place on the twenty-first of the following April, and at that time the appendage expanded to three-fourths the size of its fellow of the right side, and in every respect was perfectly normal, its articulations and setae being complete. Compare Figs. 14 and 15, Pl. I. Fig. 14 shows the tail-fin with regenerated left appendage before the moult had taken place, and Fig. 15 the same after the moult.

Several other similar instances have come under my notice during the course of my observations. I recently found in a collection of *C. gracilis* a small crayfish, about 20 mm. in length, that had lost almost the entire telson, yet a new and apparently perfectly normal one was being regenerated (Figs. 16-17, Pl. I). Fig. 16 shows a dorsal view of this regenerating telson enlarged ten times. Evidently no moult had taken place since the injury, for the articulation between proximal and distal segments is only partially outlined, and only a few irregular, short setae are present. The new telson is not perfectly symmetrical. A ventral view is shown in Fig. 17. The indications are that the entire telson had been removed, yet the regenerated anal orifice is perfectly normal, except that it is somewhat nearer the posterior end than in an uninjured telson.

3. SWIMMERETS.

My experiments upon the swimmerets have not been very extended, but I have found none to regenerate except the first pair in the male, which are modified as accessory reproductive

organs. In the case of the other abdominal appendages, except the sixth pair, regeneration, if it does take place, is very slow in beginning. Morgan ('98, p. 294) showed that in the hermit crab a very small percentage of these appendages regenerate, and that the process is very slow in beginning. He suggests that the difference between the rate of regeneration in the abdominal and thoracic legs may be partly due to the difference in food-supply which the two sets of appendages receive.

4. ANTENNAE.

In regard to the regeneration of the antennae I can add little to the observations of others on the lobster, the hermit crab, and other Decapoda. The process is essentially the same in the crayfish as has been described by Herrick ('95, p. 106) for the lobster, except that, according to my observations, regeneration does not take place at different levels along the flagellum. In no case that has come under my notice has regeneration of the flagellum taken place except from the base. In cases where only a part of the flagellum had been removed, I have never observed any indications of regeneration. I have never experimented, however, upon very young individuals, and it may take place in them.

When the antenna is broken off at the base of the flagellum, the regenerated portion first appears as a papilla or bud; then, as it grows, it becomes coiled back upon itself and, after a moult, assumes a normal appearance, except in size. Fig. 18, Pl. I, shows a dorsal view of a regenerated right antenna. No apparent increase in size will take place until after the next moult, for the new portion has already become red.

5. GILLS AND EXOSKELETON.

At the beginning of my work I tried a few experiments upon the gills and exoskeleton. The results of these were,

however, only negative. In several crayfish in which the branchiostegite was cut away, the cut edge seemed to heal over, but new setae did not develop. None of the individuals, however, lived through a moult, and it can not be told with certainty how much regeneration actually took place. In other crayfish the carapace was removed from over the pericardial chamber, but no indication of real regeneration was obtained, even when the hypodermis was left uninjured and only the hardened shell removed; but here again I have never succeeded in keeping the individual operated upon alive for more than two or three weeks. In a number of crayfish a part of the exoskeleton was removed from between the sterna and the abdomen. The wound healed over in these cases and left an enlarged knob of tissue covered by a brown cuticle.

My experiments in removing the gills were never successful. In order to observe the gills is was necessary to cut away part of the carapace overhanging the gill chamber, and crayfish operated upon in this way soon died.

6. REGENERATION OF APPENDAGES FROM LEVELS OTHER THAN THE SECOND JOINT.

It very seldom happens that appendages are broken at any joint except the one between the basipodite and the ischiopodite. This is true not only of the chelipeds but also of the other appendages. Occasionally, however, a crayfish is found in which a leg has been broken off at some other level. If this happens in the chelipeds, the limb is usually thrown off later at the regular breaking-joint, unless the injury occurs in the last one or two segments. Then, no regeneration appears to take place and the wound merely heals over, but at the next moult the appendage is restored to a normal condition. I have only observed one instance of the cheliped regenerating from any level other than the breaking-joint. In this case the regeneration was taking place from the distal end of the meros.

In the ambulatory appendages it is not so unusual to find them broken at different levels and regeneration from these levels taking place. Fig. 19, Pl. I, shows a ventral view of the regenerating right last leg of *C. gracilis,* 35 mm. in length. This appendage was broken off between the third and fourth segments. The new portion is three days old.

I have never known of a single instance occurring under natural conditions, where an appendage was broken off at a level *proximal* to the breaking-joint. My experiments with appendages removed below the second joint have never yielded positive results. New tissue is formed, but in no case has it ever assumed the appearance of a regenerating appendage. I have never seen an individual moult, however, after an appendage had been removed below the usual breaking-joint. I can not speak conclusively on this point.

Morgan (:00, pp. 2 and 3) states that in the hermit crab regeneration takes place very readily at a point proximal to the breaking-joint. In the crayfish, however, it is at least certain that regeneration does not occur as readily, or in the usual manner, proximal to the breaking-joint as at that point or distal to it.

In a collection of crayfish I once found an individual with a double chela (Fig. 20, Pl. I). This chela was evidently a regenerated one, for it was very much smaller than the one on the opposite side and was of less than the normal size for the crayfish which bore it. The two segments proximal to the breaking-joint were of the same size as the corresponding segments on the opposite side, thus indicating that the break had taken place at the usual level.

Deformed claws in lobsters seems to be a much more usual occurrence than in crayfish. Herrick ('95, pp. 144-148) gives some interesting notes on this phenomenon, and also mentions the fact that these deformities have attracted the attention of naturalists for more than two hundred years. Recent writers

who have given special attention to the subject are Faxon ('81) and Bateson ('94). Bateson (l. c., p. 537), reports a crayfish with three extra claws. Among thousands of crayfish that have passed through my hands I have not found as many as a dozen that presented any sort of deformity. At all events the species of crayfish with which I am most familiar, viz., *Cambarus gracilis, C. virilis, C. immunis,* and *C. rusticus* are unusually free from deformities of any kind.

7. EYES.

As was mentioned in the historical summary, some earlier observations have been made upon the regeneration of the eyes of Decapods. Herbst, however, is the only experimenter who has given any special attention to the subject. The results of his work have already been discussed (pp. 5-9). Chantran ('73) also gives a brief account of the process, but I have been unable to procure his original paper. Morgan ('98) discusses very briefly the regeneration of the eyes of the hermit crab. It seems at least certain from Herbst's and Morgan's work that crabs and shrimps are much more favorable forms for experiments than crayfish. From their accounts I should judge that regeneration takes place much more rapidly, in the hermit crabs at least, than in crayfish; and also that there is not nearly so much difficulty in keeping them alive as I have experienced in the case of crayfish. Besides the usual difficulties which have already been mentioned, a large percentage of the individuals whose eyes had been removed, died shortly after the operation. Death, in these cases, I attributed to loss of blood and nervous shock. Fewer died when only the corneal part of the eye was cut off than when the whole stalk was removed, and small individuals usually seemed more hardy than larger ones. The point of paramount importance here, as in the case of the appendages, is to keep the crayfish alive through at least one moult after the removal of the eye.

This was also noted by Chantran who found that nothing definite could be determined concerning the regeneration previous to a moult.

In the case of the hermit crabs, experimented upon by Morgan, apparently a moult is not necessary in order that the regeneration of the eye should become evident. At least no mention is made of a moult having taken place. In his first series of experiments, Herbst does not mention the occurrence of a moult, but in his later work he distinctly states, for *Sicyonia sculpta* at least, that two or three moults must take place before any distinct structure appears. He also mentions moults as having occurred in a number of other instances. In the hermit crab Morgan found the regenerative processes to go on very rapidly, for his experiments were begun August 18 and brought to a close September 15 ('98, pp. 294-5). In cases in which only the top of the eye was removed, less than a month was required for the regeneration of a new pigment spot, and Morgan states that in some instances the pigment body was rounded and sharply defined. Eyes of this sort when sectioned showed that the essential eye structures were being regenerated. As no figures of such sections are shown I am unable to judge of the progress the regenerating parts had made. It scarcely seems possible that sufficient regeneration could have taken place, in so short a length of time, to enable one to form any definite conclusions as to what the final outcome would be. As was mentioned before, Morgan found that, after removal of the entire eye, an antenna-like structure instead of an eye was regenerated. The results of Herbst and Morgan differ in the fact that the regeneration was more rapid, and a larger percentage of the individuals regenerated, in the case of the hermit crabs than in that of the shrimps. This, however, may have been largely due to the difference in the season of the year. Most of Herbst's experiments were begun late in the fall or during the winter, while Morgan's were carried

on during the summer. Morgan's entire series of experiments was begun and ended within a month, while in no case does Herbst report any definite regeneration to have appeared within less than three months, and then not until after two or three moults had taken place.

In my experiments upon crayfish it has proved absolutely true that nothing definite concerning the regeneration can be ascertained until after a moult, although the length of time between the operation and the appearance of the regenerated structure varies in individual cases very greatly. It is true that, when only the distal portion of the eye is removed, an apparent regeneration takes place in a very short time, but it is only a partial restoration in size and not a true functional regeneration. This point will be referred to again and more carefully considered.

The eyes of crayfish have been operated upon at three different levels and at varying angles. First, a part of the cornea, sometimes just the top, was cut away, and sometimes a portion was cut from one side; second, the entire corneal surface was removed; and, third, the whole or the greater part of the optic peduncle was cut away. In the latter case of course, the optic ganglion was either wholly or partially removed.

The results obtained from these experiments will be discussed under two main headings; first, regeneration after removal of a portion of the eye; and second, regeneration after removal of the entire eye. In all cases only one eye was operated upon. I am unable to say how large a percentage of the individuals used in each case ever yielded results of value. Many of them died before reaching the moulting period, and consequently I found it impracticable to keep a record of any except those that were killed for examination or those that exhibited noticeable regeneration before dying. Owing to the rapid disintegration of the tissues no satisfactory results could be obtained from

an internal examination of the regenerated eyes of individuals that had died. In every case I have kept a record of the time occupied by the experiment and of the season of the year. With these preliminary statements, which apply equally to both cases, I shall proceed to the discussion of observations and results.

(*a*) *Regeneration After Removal of a Portion of the Eye.* Under this heading are included the cases in which a part of the cornea and those in which the entire cornea has been removed. Removal of the whole or a portion of the cornea is always attended with more or less bleeding, but a clot of blood is soon formed. Within half an hour after the operation the inner tissues bulge out above the level of the cut edges. The swollen appearance persists for a few days, and in the meantime a brownish crust is formed over the cut surface. This gives the appearance of a very rapid regeneration, while in fact practically none has taken place. Later the swollen end seems to retract, and externally regeneration does not appear as advanced as before. The swelling and subsequent contraction may give rise to the extremely irregular contour which a regenerated eye usually presents. From now on an actual growth takes place and within a few weeks or months, as the case may be, the eye attains a size approximately equal to that of the uninjured one. One specimen in which the top of the eye had been removed on October 29 had apparently undergone a very considerable regeneration by November 10; by the eighteenth of November the eye had regained almost its full size. A casual observation showed no particular difference between this eye and the normal one, except in color. The regenerating eye was brown instead of nearly black, the color of the uninjured eye. Examination of the new growth with a lens, however, showed immediately that no corneal facets had been formed, and, since neither corneal facets nor retinular pigment had been developed, it can not be said that there was

any indication of a true eye present. Sections of an eye in this condition show no well defined structures distal to the optic ganglion except the lamellated cuticle (Fig. 21, Pl. III).

Another conspicuous difference between a normal eye and a regenerating one is the rough jagged surface that the regenerating eye presents. Such an eye lacks the symmetrical form of an uninjured one. I have always attributed these irregular outlines chiefly to the crushing and cutting of the eye when it was operated upon. After a moult the eye is often more regular and may approach very nearly the normal shape, but in practically every case, it is more or less misshapen. Sometimes the new portion seems to be developed mainly on one side; sometimes the top of the eye presents, instead of a smooth convex surface, a rough and wrinkled one. Sections of these eyes show several very interesting points, but fail to prove with certainty that eyes in any true sense are being regenerated, that is, eyes capable of functioning as organs of sight. The condition of these regenerating eyes is made plain by an examination of Figs. 21-23, Pl. III. Fig. 21 shows a section through the central portion of an eye from which the cornea had been removed forty-four days before. The points *a* and *b* mark the limits of the regenerated cuticle. On the left side the line of union extends from *a* to *á*, but on the right the break at *b* is abrupt. The newly developed cuticle is very much less compact than the old cuticle, but is of greater depth. In this instance the irregularity of the surface, of which mention has been made, is caused by the cuticular growth. The remnants of the old crystalline cones (*cr.*) are being cast off by the new cuticle which is developing under them. The section passes through the optic nerve (*op.*) and through the optic ganglion (*gl.*). Just beneath the cuticle is seen a fairly complete row of cells with well defined nuclei (*hy*), which I take to be the hypodermis from which the new cuticle is being secreted.

It is noticeable that there is no such well-defined row of cells along the sides beneath the old cuticle (*o. c.*). At each side and above the distal segment of the optic ganglion, is a very conspicuous, loose network of connective-tissue fibres (*cc.*) which is the characteristic tissue formed in the regenerating eye. At each side are bands of muscle (*m.*) belonging to the eye-stalk. In the upper right-hand portion of the figure are shown several small masses of pigment granules, which have no definite size, shape or arrangement and are probably a part of the pigment of the old retina that had not been entirely removed. Although undoubtedly new tissue has been formed, there is nothing to indicate that a functional eye is being regenerated.

In Fig. 22 is seen a regenerating eye that is even more abnormal in shape than the one shown in the preceding figure. Here the irregularity of outline is not due to unequal development of the cuticle, but of the tissues beneath the cuticle. The regenerated portion of the cuticle extends from *a* to *b* and presents, instead of a smooth convex outline, a very much convoluted one. Even the lower, old portion of the eye appears to have suffered considerable distortion. In the depression at *d* and around the outer surface of the new cuticle is a granular aggregation which probably is partly a mucous secretion from the glands beneath the cuticle, and partly degeneration products, together with an admixture of bacteria. At *ba* there are numerous small, ill-defined bodies which can only be interpreted as being a bacterial zoögloea. In this section the hypodermis forms a continuous layer beneath both old and new portions of the cuticle. Besides the optic nerve (*op.*) and ganglion (*gl.*) very little internal structure is to be seen, except the loose connective tissue network. To the right at *m*, are some small muscle bands and just internal to these is a well defined connective tissue band. As in the preceding figure, there is nothing to indicate that the ommatidia are being regenerated.

Fig. 23 shows still another abnormality in the growth and development of the cuticle. Here only the calcified cuticle and underlying hypodermis are shown. The internal structure is practically identical with that of the preceding figures. In this case only one side of the corneal surface had been removed; an oblique cut passing along the line *ab* removed perhaps a fourth of it. The regenerating tissues are but ten days old. The hypodermis is a continuous layer beneath both old and new cuticle. On the right the cuticle has grown inwards a considerable distance; or probably it would be more correct to suppose that the cuticle had formed from *b* over to *a* before an appreciable amount of tissue had been developed; then, the internal tissues growing rapidly forced the hypodermis and cuticle back, so that an apparent invagination of the cuticle was produced. There have been, it seems, two periods of activity in the secretion of the new cuticle. The outer, older portion (*n. c.*) seems to be more compact than the younger, inner part (*n. c.*). The inner layers of the new cuticle, together with the hypodermis form a continuous structure beneath both the old cuticle and the older part of the new. From *a* to *d* are what appear to be some remnants of the old corneal facets which are being thrown off.

Fig. 24, Pl. III, is a section of an eye that had been operated upon forty-four days before. Internally it shows the same structures as have been described in previous figures. However, this section is taken eccentrically and shows none of the optic nerve and but little of the optic ganglion. The only new feature in the section is the conspicuous difference between the old and new cuticle. The old cuticle (*o. c.*) shows many more lamellae and those lamellae much more compactly arranged than in the new cuticle (*n. c.*). On the right side, the union of the old and new cuticle at *a* is rough and uneven and less perfect than at *b*.

In only one instance have I ever found any indication of

regenerating corneal facets. A crayfish, from which a part of the eye had been removed, moulted, and a week or ten days later died. The tissues were of course in such a condition that they could not be used for histological purposes, but the cuticular portion was stripped off and examined and the softer tissues beneath teased out and examined under a microscope. The inner tissues showed no sign of either ommatidia or pigment, but a part of the cuticular covering appeared to be developing irregular corneal facets. To be sure, without more evidence than this it is impossible to say whether or not the eye is really regenerated. A single instance in which the parts removed are wholly restored is sufficient to prove that functional regeneration may take place, but as yet this single instance is lacking.

However, at the present writing, May 3, 1901, a small crayfish from which a part of the cornea had been removed on April 9, moulted. Externally, the regenerated eye presents a more normal form than any I have as yet seen, but no corneal facets are visible and the eye is not as dark in color as normally. It has been fixed in Flemming's fluid preparatory to sectioning. Judging from the exterior, this is the most favorable material of the sort that I have had. Fig. 26, Pl. IV, shows an external view of the eye. The part of the cornea removed was taken somewhat to one side rather than at the distal end. This is still evident in the regenerated eye from the apparent encroachment of the stalk portion upon the corneal portion shown at *c*. Otherwise, the eye has much the same appearance as the normal one, except that the corneal portion is relatively much smaller.

Since writing the above the eye shown in Fig. 26 has been sectioned and another crayfish in which the entire cornea had been removed has moulted (Fig. 35, Pl. IV). Both eyes of the latter have been sectioned. Sections of the eye, shown in Fig. 26, Pl. IV, disclose several interesting features. On one side and

through the center of the eye unmistakable ommatidia are present, presumably those belonging to the part of the cornea that had not been removed. Fig. 26 shows the cornea to be almost normal in shape and position, although much reduced in size. It is significant that there is no indication that the injured optic ganglion is being regenerated, and also that the cuticle is just as heavily developed over the corneal portion as over the stalk portion of the eye. But perhaps the most striking feature is what seems to be an increase of muscle tissue along one side and reaching almost to the top of the eye. Fig. 26 a, Pl. III, shows a section taken eccentrically and from the side which is almost destitute of ommatidial structure. Almost the entire interior of the section is taken up by bands of muscle fibres (*m*). To the right, there is still the remains of the optic ganglion (*gl*) and around the periphery are loose connective tissue fibres (*c. c.*); inside the cuticle is a well defined hypodermis, and in the upper part of the figure the irregular remains of some of the crystalline cones. The large amount of muscle tissue can scarcely be explained as due to the plane in which the section chanced to be taken; for the normal eye of the opposite side was cut in connection with the regenerated one, and shows no such preponderance of muscle. Besides, among the large number of normal eyes that I have sectioned in different planes, none show any such development of muscle. It seems evident that more than the normal amount of muscle tissue is developing here at the expense of other tissues. Although only twenty-four days have elapsed since the removal of the part of the eye, new muscle tissue has completely developed. This may be seen by reference to Fig. 41, Pl. IV, which shows some highly magnified muscle fibres taken from region *a*, Fig. 26 a, Pl. III.

Fig. 35, Pl. IV, shows both normal and regenerating eyes of the crayfish referred to above. The entire cornea was

removed April 9, 1901, and the crayfish moulted about six weeks later. The great difference in size between the regenerating eye and the normal one, and the evident pigment spot at the distal end of the former, are noteworthy. Figs. 36 and 37, Pl. II, shows sections of the regenerating eye. In Fig. 36, merely the cuticular outline, the hypodermis, and the arrangement of the pigmented portion at the distal end are seen. The pigment shows a somewhat systematic arrangement, as if ommatidia were being developed. But the pigmented portion lies close under the cuticle. There is nothing to indicate that crystalline cones or corneal facets are being regenerated. The cuticle is equally as dense and thick over the pigmented portion as over the remainder of the eye, and it is very noticeably thicker than the cuticle over the corneal portion of the normal eye. Fig. 37 shows the same features as Fig. 36, and in addition, a part of the optic ganglion (*gl.*). From this figure it will be seen that there is no continuity between the optic ganglion and the pigmented structures, the latter being fairly well separated from the deeper parts by a band of connective tissue. The position of the muscle fibres (*m*) would seem to indicate that the connection between the peripheral eye structures and the optic ganglion is being severed. The ganglion-cells themselves have not the exact appearance of those of the opposite, normal eye. Their outlines are not quite so clearly defined and they are rather more irregular in size. Yet the difference is not clearly enough marked to enable me to decide whether or not the ganglion-cells of the regenerating eye are actually degenerating. But at all events, an examination of the entire series of sections gives no evidence whatever that regeneration of the nervous portion of the eye has taken place.

From the evidence presented by the last two specimens it is hardly possible to conclude that a functional eye has been regenerated. On the one hand, the development of pigment has taken

place, and the pigment-cells approach, to a certain extent, the normal arrangement. On the other hand, however, there is no indication at all that the optic ganglion, the crystalline cones and corneal facets are regenerated; and, furthermore, the cuticle over the pigmented region is as thick as it is over the stalk. It is true that, when only a part of the cornea is removed, as in the case cited on pp. 29-30, the remaining portion may continue to be entirely functional, but here the connection between the ganglion and the ommatidial region has not been completely severed.

(b) *Regeneration After Removal of the Entire Eye.*—This portion of the subject includes, perhaps, the most interesting phase of the question. There are in these experiments results which are at least definite, even though but little understood. However, they are not more inexplicable than other heteromorphic structures.

Whenever the entire eye, together with the whole or greater part of the eye-stalk, is removed, *the eye as an organ of sight is never regenerated.* A new structure may, and in many cases, does develop, but instead of an eye it is a different kind of appendage. Usually this structure is jointed, sometimes like the flagellum of an antenna, but in other cases a pair of flagella like those of the antennules are formed; and again the structure may have no resemblance whatever to a normal appendage but consists of a short two or three-jointed structure similar neither to the eye nor to any appendage the crayfish possesses. The last mentioned structure resembles the appendage that Herbst (loc. cit., pp. 545-6) designated as horn-like (*hornähnlichen*). In discussing the results obtained after removal of the entire eye, I shall refer to a series of crayfish which illustrate the different forms that the regenerated structure may assume.

Type I: *A pair of flagella regenerated.* The first instance observed of the development of these peculiar heteromorphic

structures were in two individuals (*C. virilis*) of medium size from which the entire right eye had been removed on March 15. One of them moulted April 9, the other April 15. At the time of this moult neither of the crayfish showed any indication of a new structure. The individual that moulted April 15, underwent a second moult on May 24, and at this time a well-developed antenna-like structure made its appearance. The crayfish also that moulted April 9 moulted a second time on May 25, and again the same kind of segmented structure appeared. In each case the appendage consisted of a pair of flagella, each of which was composed of a number of segments. The flagella did not project directly outward but curved slightly forward. The inner or anterior flagellum was smaller and shorter than the outer, posterior one. The flagella on the first individual were longer and slenderer than those upon the other one. Unfortunately, however, I lost the specimen before a drawing had been made of this interesting structure. Fig. 27, Pl. IV, shows the shorter, blunter antenna-like product of regeneration in the second crayfish, together with the eye on the opposite side. There is no enlarged segmented base, as in the normal antenna or antennule, but only a slightly enlarged and rounded elevation from which the flagella arise. No conspicuous setae are developed upon them.

After obtaining these two specimens a number of other crayfish were operated upon without any definite results, the trouble being that most of them died before a moult occurred. It may be said, however, that a majority of those that died without moulting were from among the number that were operated upon in the fall and were kept in the laboratory all winter.

Type II: *A single flagellum regenerated.* Besides the two crayfish discussed under Type I, I have obtained but two or three specimens that showed similar structures; and in these

instances a single flagellum and not a pair of flagella was developed. These crayfish were smaller than those mentioned under Type I and all belonged to *C. gracilis* instead of *C. virilis*. The regenerated structure of Type II is represented in Fig. 33, Pl. IV. The crayfish from which this figure was obtained had the entire left eye removed on April 21, shortly after the animal was brought into the laboratory. On June 19 it moulted and at that time there appeared a segmented structure similar to an ordinary flagellum. The flagellum consisted of fourteen segments springing from a slightly elevated base. Before the moult occurred the structure was coiled back upon itself just as in the regenerating flagellum of an antenna. Even after the moult, it did not uncoil immediately. Fig. 33 shows the flagellum after uncoiling and in its relation to the antenna and antennule. The flagellum from the eye-stump curves upward towards the rostrum and is longer than the rostrum; compared with the flagellum of the antennule it is shorter and thicker. The other appendages of this type showed no features not seen in this, except that in one case, at least, the regenerated flagellum did not possess as many segments as are represented in Fig. 33. A shorter time, however, had elapsed between the removal of the eye and the occurrence of the moult.

Type III: *Segmented horn-like structures.* A number of crayfish from which the entire eye had been removed showed, after moulting, not an antenna-like structure, as in the previous cases, but a short horn-like growth which consisted of two, three, or even as many as five or six segments. Types of this structure are shown in Figs. 31, 32, 34, Pl. IV. Fig. 31(*n*) shows a regenerated appendage consisting of but two segments besides the rounded base; the distal segment is relatively very much smaller than the proximal one. The segments are not movably articulated and the whole structure is covered with a dense hard cut-

icle. The horn-like appendage is shown from the side together with the antenna (*at*) and antennule (*an*) from the same side. The rostrum has been cut away so as to better expose the regenerated part. A similar type of structure is indicated in Fig. 32 at *n*. Here, however, there are three segments and the rounded base, and the arrangement of the segments gives the appendage the appearance of having been spirally twisted. As in the preceding case, the whole appendage is covered with a dense cuticle and possesses no movable articulations. The regenerated structure shown in Fig. 34 (*n*) consists of six segments but lacks the rounded elevated base. In this case, the appendage curves upward and then downward, at the same time twisting inward, towards the median line. In this figure, the antennule is not shown. There is a noticeable difference between these appendages of the crayfish and the somewhat similar structures described by Herbst for the shrimp in the absence of long, sensory hairs in the former. It will be remembered that the *hornähnlichen* processes described by Herbst, were thickly beset on the ends and ventral sides by long segmented setae, considered by him to be of a sensory nature. He seems to imply, although he does not definitely state it, that these, in a measure at least, compensate for the loss of the eye. In the case of the horn-like structures in the crayfish, no setae whatever are present and there is no external indication at all that they are more sensitive than a leg or maxilliped.

Type IV: *Unsegmented horn-like structures.* The chief difference between this type of regenerated appendage and Type III consists in the fact that here only one segment is regenerated. Fig. 30, Pl. IV, shows a regenerated appendage of this type. The crayfish which furnished this particular instance was a small individual of *C. gracilis.* On May 9, the entire eye was removed; the individual afterwards moulted on May 18 and

again on August 18 and finally died on August 20. There is no external indication whatever that the regenerated structure, Fig. 30 (*n*), is segmented. The basal portion (*b*) represents merely a part of the connection between the regenerated structure and the eye on the opposite side. There is little ground for supposing that, had the individual lived longer, the appendage would have become segmented; for more than three months had elapsed between the removal of the eye and the death of the crayfish and two moults had intervened. This is nearly twice as long as the period occupied in the development of the appendage described under Type II (Fig. 33, Pl. IV), and in the latter case fourteen segments were regenerated.

The horn-like processes of Types III and IV agree in the fact that in all instances the process is directed somewhat forward and is usually curved upward and at the same time slightly inward toward the median line. They further agree in the presence of a hard chitinous cuticle and in the absence of setae.

Type V: *Indefinite structure regenerated.* Finally there remain to be considered instances in which no definite regeneration takes place. The number of individuals, which may be considered as belonging to this negative type, are numerous. In the majority of such instances, however, the crayfish died before the occurrence of a moult, or the moult occurred in a very short time after removal of the eye. It is, therefore, impossible to say what the final outcome might have been. In most cases in which the entire eye had been removed, there were no external indications whatever of any regeneration until after a moult, but this is not true of every instance. Fig. 28, Pl. IV, shows the normal left eye and the stump from which the right eye was removed four months before. The animal died without having moulted after the operation. The new tissue that had been formed is represented by the shaded portion distal to the line

c. There are no external signs of differentiation, as constrictions or folds in the tissue, and the cuticle is not even hardened. Apparently nothing is present but a knob of indifferent tissue. Sections of this knob show nothing but a cuticle consisting of numerous lamellae and a small amount of connective tissue. In Fig. 29, Pl. IV, the uninjured left eye and the stump of the right eye of another individual are indicated. In this case, a moult took place about three months after removal of the entire eye, yet the regeneration here is apparently not further advanced than in the preceding case. The regenerated portion shows no resemblance to an eye or any other appendage. The optic nerve still persists, for it can be seen passing into the mass of tissue on the right (*op*). No more new tissue has been formed than would equal in volume the stalk of the normal eye. It does not seem probable in this and in the preceding instance that any definite structure would have been formed, if the crayfish had lived for a much longer period.

(c.) *Theoretical Considerations.* In considering these cases of heteromorphosis, it is noteworthy that in no instance is there anything like a basal protopodite present. In every case the main structure arises from a slightly rounded eminence which is in no way similar to a protopodite. This is again different from the majority of cases cited by Herbst. In all of his figures, except one, there is shown some sort of a base from which the principal portion of the appendage arises. The base is not altogether similar to a typical protopodite, yet there is sufficient resemblance to suggest it.

Undoubtedly, as Herbst suggests, the regenerated heteromorphic structure receives a plausible explanation on the ground of reversion to an ancestral condition. The question as to whether or not the eyes are modified appendages is difficult of solution, and the study of embryology has not yielded a defi-

nite answer. Yet, from an examination of the regeneration of the eyes of crayfish, it may at least be said that there are certain reasons for regarding the eyes as modified segmental appendages, and the heteromorphic structures which arise when the entire eye is removed indicate strongly that this interpretation is the correct one.

One of the most significant points in this connection seems to me to lie in the fact that the structure which is regenerated is not always an antenna-like organ. For instance, the structure represented in Fig. 30, Pl. IV, shows no segments whatever but has very much the appearance of the bud of an ordinary appendage before constrictions appear which mark the future joints. And furthermore, the fact that the regenerated structures sometimes appear in an antenna-like form, sometimes with one, sometimes with a pair of flagella, may point to a gradual transformation of the typical appendage, the appendage in its phylogony, having passed through an antenna-stage before reaching the condition of an eye.

There may be some objection to regarding this heteromorphosis as atavism on the ground that the regenerated structure lacks a basal protopodite. This, however, might be explained on the hypothesis of partial reversion. And, if it were possible to keep the same individual alive long enough to remove successively the regenerated structures, as can be done in other regenerated appendages, there would probably finally be regenerated an appendage more nearly approaching the typical form. However, Herbst, in some of his experiments, removed the heteromorphic structure, both wholly and in part, and found that a similar structure was always regenerated. In the shrimp, Herbst found an indication of a segmented basal portion, but the segments possessed no movable articulations. Although here there was a nearer approach to an ordinary appendage than I

have found in the crayfish, still it was far from being typical. In spite of the differences in the character of the regeneration of the shrimp and crayfish, there are sufficient similarities to point to a close relationship; and both instances may be regarded as arguments in favor of considering the Decapod eye a modified segmental appendage. Morgan's experiments upon the eyes of the hermit crab should be considered as belonging to the same series. But as he gives no details, I am unable to say whether the regenerated structures in the crab are more nearly like those regenerated by the crayfish or those regenerated by the shrimp.

It is possible that, if the conditions for experiment could be rendered more natural and hence more favorable, many additional facts could be learned which would be decisive in favor of reversion or against it, but at present the question must remain an open one.

IV. GENERAL CONSIDERATIONS.

It is not my intention to enter upon a detailed, theoretical discussion of regeneration. The phenomena of regeneration are not more explicable in the crayfish than in other animals, and at present it is not theory but fact that will prove useful in the ultimate solution of the problem if a solution is ever to be reached.

The points of interests to be mentioned here are to be found in the similarities and differences between my own experiments and those of others. For instance, in Herrick's experiments upon the lobster, he comes to the conclusion that the power of regeneration is regulated according to the uses of the parts injured. He says (loc. cit., p. 107), "The power of regenerating a lost part varies in both vertebrates and invertebrates in direct proportion to the physiological importance of the part, as Weismann has clearly shown."

Later investigation has not substantiated this view. Morgan, from his experiments upon the hermit crab, which have been mentioned in an earlier part of this paper, was led to take a precisely opposite ground in regard to the relation of regenerating capacity to the physiological importance of the part concerned and its liability to injury. He found that the hermit crab was capable of regenerating any appendage that was removed, even though under natural conditions, the possibility of injury to the appendage, as in the case of the abdominal appendages which are not exposed, was practically precluded.

He also found that appendages frequently injured regenerated not only at the usual breaking joint, but were capable of regenerating from a point either above or below that level. From these observed facts he concludes that for the hermit-crab at least, there is no relation whatever between power of regeneration and liability to injury. Not only for the hermit crab, but for all other animals that are capable of regeneration, he denies the existence of any such relation.

My own observations upon the crayfish tend to substantiate Morgan's view. I have found that appendages do regenerate which under normal conditions are not usually injured, and that they are capable of regenerating from levels other than that of the usual breaking joint. In my paper on The Crayfish of Missouri (:02) I mentioned the extreme uniformity of parts in *C. gracilis,* a species which spends nearly its entire life in burrows and is therefore protected from injury.

This uniformity shows that the appendages are seldom or never injured under normal conditions. In only one instance, and that has been since the above paper was written, have I ever found an adult of *C. gracilis* that had lost an appendage. Yet I found that when young individuals of this species were used for experiment, new appendages were restored as fre-

quently and as rapidly as in *C. virilis*, a species in which injuries often occur under normal conditions. The above facts furnish additional evidence for Morgan's contention that the capacity for regeneration is independent of the physiological importance of the part or its liability to injury. It is true, however, that the physiological importance of a part bears a certain relation to the rate of regeneration, which is doubtless to be explained on the ground of differences in nutritive conditions. The greater food-supply of a part which exhibits a higher functional activity may well account for a more rapid regeneration than in the case of a part which is of less physiological importance. I have found that the thoracic appendages of the crayfish, for example, regenerate more rapidly than the swimmerets.

V. SUMMARY.

1. Experience has shown that the most favorable season of the year to experiment upon crayfish is during late winter and early spring, a short time before the moults are likely to occur; also that crayfish of small or medium size afford the most favorable material for experiment.

2. The age of the individual, the season of the year and the length of time the crayfish has been kept in confinement before being operated upon influence the results. Crayfish that have been brought in recently should always be used. The inactive life, which they necessarily lead in the laboratory, lowers their vitality and consequently reduces the chances of success.

3. Regeneration of the chelipeds normally takes place from the distal surface of the second joint; it may occur, however, from a higher level, but it has never been definitely proved that it takes place from a lower level. Normally, the appendage appears on the exterior but it may be developed within the old stump.

4. In the other thoracic appendages regeneration is similar to the same process in the chelipeds.

5. In both chelipeds and ambulatory appendages, if an injury occurs near the tip, the limb is not thrown off at the breaking joint, nor is there any apparent regeneration before a moult takes place. At the time of a moult the appendage appears restored.

6. The flagella of the antennae and antennules are readily regenerated when broken off at the base. When broken off at higher levels I have never definitely determined that regeneration occurs.

7. I have not found that the swimmerets, i. e., the second, third, fourth and fifth abdominal appendages, regenerate. Experiments, however, on these parts were not extensive.

8. In the male the first pair of abdominal appendages regenerate. These appendages are modified as accessory reproductive organs.

9. The telson and also the sixth pair of abdominal appendages, which with the telson form the tail-fin, are regenerated.

10. Parts of the exoskeleton and the gills were experimented upon without definite results.

11. When only the distal part of the eye is removed an apparent regeneration takes place in a very short time. Examination, however, shows that true functional regeneration has not occurred. The ommatidia are not regenerated and in only one instance have I found any indication at all that the corneal facets were being restored. The eye usually develops in an irregular, abnormal form, the irregularity sometimes being due to the unequal development of the cuticle and sometimes to the tissues beneath.

12. When the whole eye is removed regeneration may or may not take place. If any structure is regenerated it is not

an eye but either a short appendage that consists of one, two, or three segments, or a longer structure consisting of either one or a pair of antenna-like flagella.

13. Before any regenerated part can assume a normal appearance it is necessary that a moult take place. Before a moult the regenerated portions are much compressed and when released may expand to twice the proportions permitted by the confining cuticle.

14. The general results of this series of experiments substantiate the view that the power of regeneration is independent of the liability of the part to injury. The results also show that the rate of regeneration depends both upon external factors and the physiological condition of the animal operated upon.

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BIBLIOGRAPHY

BATESON, W.
'94. Materials For the Study of Variation, 1894.

BROOKS, G.
'87. Notes on the Reproduction of Lost Parts in the Lobster (Homarus vulgaris). Prc. Roy. Physical Soc. CXVI, pp. 370-385, 1887.

BROOKS, W. K., and HERRICK, F. H.
'91. The Embryology and Metamorphosis of the Macrura. Mem. Nat. Acad. Sci., V, 1891.

CHANTRAN, S.
'73. Expériences sur la régénération des yeux chez les écrevisses, Compt. Rend, LXXVI, 1873.

FAXON, W.
'81. On Some Crustacean Deformities. Bull. Mus. Comp. Zool. at Harvard College, VIII, No. 13, 1881.

GOODSIR, H. D. S.
'44. A Short Account of the Mode of Reproduction of Lost Parts in the Crustacea. Ann. and Mag. of Nat. Hist., XIII, 1844.

HERRICK, F. H.
'95. The American Lobster, Bull. U. S. Fish Commission, 1895.

HERBST, C.
'96. Ueber die Regeneration von antennenähnlichen Organen an Stelle von Augen. I. Arch. f. Entw.-mech., II, 1896.

HERBST, C.
'96a. Versuche an Sicyonia sculpta, II. Vierteljahrsschr, d Naturf.Ges., Zurich, XLI, 1896.

HERBST, C.
'99, :01. Weitere Versuche, u. s. w., III u. IV. Arch. f. Entw.-mech., IX u. XIII, 1899 u. 1901.

HOFER, —.
'94. Ein Krebs mit einer Extremität statt eines Stielauges. Verhandl. d. deutsch. zool. Ges., 1894.

MORGAN, T. H.
'98. Regeneration and Liability to Injury. Zool. Bulletin, I, 1898.

MORGAN, T. H.
'00. Further Experiments on the Regeneration of the Appendages of the Hermit Crab. Anat. Anz., XVII, 1900.

RÉAUMUR
1712. Sur les diverses reproductions qui se font dans les écre

visses, les omars, les crabes, etc., et entre autre sur celles de leurs jambes et de leurs écailles. Mém. de l'Acad. Roy. des Sci., 1712.

STEELE, M. I.,
'02 The Crayfish of Missouri. Publications of the Univ. of Cincinnati, Bull. X, 1902.

EXPLANATION OF PLATES

REFERENCE LETTERS:

a, *b*, *c*, etc. refer to particular topographical regions of figures described in the text.

an.	antennule.
at.	antennae.
ba.	bacteria.
b. m.	basal membrane.
ca.	carapace.
cc.	connective tissue.
c. f.	corneal facets.
cr.	crystalline cones.
cu.	cuticle.
g.	granules.
hy.	hypodermis.
m.	muscle fibers.
n.	regenerated portion.
n. c.	new cuticle.
o. c.	old cuticle.
om.	ommatidia.
p.	pigment.

PLATE 1

Figs. 1, 2, 3, and 4. Preliminary stages in regeneration of new chela.
Fig. 1. Smooth stump before regeneration appears externally.
Fig. 2. First appearance of bud.
Fig. 3. Constrictions marking segments have appeared.
Fig. 4. Rudiments of the entire regenerated structure laid down.
Fig. 9. Regeneration that has taken place within the old stump, behind the cuticle stretched across the wounded surface. *a*, the old stump; *b*, the regenerated portion.
Fig. 10. Same as *b* in Fig. 9, after removal of an investing membrane.
Fig. 11. Section through regenerated structure shown in Figs. 9 and 10.
Fig. 14 and 15. Regenerating 6th abdominal appendage before and after a moult respectively.
Figs. 16 and 17. Regenerating telson, dorsal and ventral views.
Fig. 18. Regenerating flagellum of right antenna, dorsal view.

Fig. 19. Leg regenerating from distal end of 3rd joint. Regenerated portion 3 days old.

Fig. 20. Double chela. Meros branched.

Fig. 38. Hypodermis from end of developing chela, 5 days old.

Fig. 39. Developing muscle fibers from central portion of regenerating chela, bud 5 days old.

Fig. 40. Developing muscle fibers from chela bud older than shown in Fig. 39, but not yet constricted into segments.

PLATE 2

Fig. 5. Cast-off shell of crayfish, indicating the number of appendages that had been broken off.

Fig. 6. Crayfish that has just moulted from shell shown in Fig. 5. Left chela broken off in moulting.

Fig. 7. Cast off shell of crayfish showing visible regeneration before a moult.

Fig. 8. Crayfish that has moulted from shell shown in Fig. 7.

Fig. 12. Developing muscular tissue from region *e* (Fig. 11). Fibers very loose and granular with large, deeply staining nuclei.

Fig. 13. Developing muscular tissue from region *a* (Fig. 11). Two bands consisting of two and four fibers respectively, separated by a broad granular space.

Fig. 36. Section of regenerating eye shown in Fig. 35. Specimen killed just after a moult.

Fig. 37. Section of same eye as Fig. 36, but more eccentric.

PLATE 3

Fig. 21. Regenerating eye. Corneal portion had been removed 44 days before. Lamellae of new cuticle very loose and very irregularly developed—extends from *a* to *b*.

Fig. 22. Regenerating eye. Corneal portion had been removed 33 days before. Outline of regenerated part very irregular, due to unequal development of connective tissue beneath newly formed cuticle. *ba*. probably bacteria that have become massed over the irregular surface ot the new cuticle.

Fig. 23. Cuticular portion of regenerating eye from which one side of cornea had been removed 10 days before. At upper left hand portion of figure the remainder of old corneal facets are being thrown off. The hypodermis is a continuous, wel defined structure beneath the whole cuticle. l

Fig. 24. Section of regenerating eye, corneal portion removed 44 days before. Section taken eccentrically. The old cuticle covers most of the surface, the new cuticle developing beneath. No well defined hypodermis.

Fig. 25. Section from same eye as Fig. 24, but less eccentrically taken. New cuticle much better developed in this region; large space between new and old cuticle.

Fig. 26a. Section through regenerating eye. Cornea had been removed 24 days. A remnant of old crystalline cones shown at *cr*. Degenerating optic ganglion (gl) on right side. Regenerating muscle fibers extending to top of eye.

PLATE 4

Fig. 26. Eye from which almost entire cornea was removed Apr. 9. Moulted and was killed, May 3.

Fig. 27. Entire right eye removed. Flagella (*aa*) appeared in three months, after crayfish had moulted twice.

Fig. 28. Normal eye and regenerated growth from a crayfish that had had entire eye removed four months before. No moult had taken place.

Fig. 29. Normal eye and regenerated growth from a crayfish whose eye was removed three months before, at end of which time a moult took place.

Fig. 30. Stump of old eye-stalk and regenerated growth that developed between May 9, the date of removal of the eye, and Aug. 20 when individual died. It had moulted twice in the interval.

Fig. 31. Side view of anterior portion of crayfish, rostrum dissected away. This structure developed between June 9 and Aug 20. A moult occurred Aug 20.

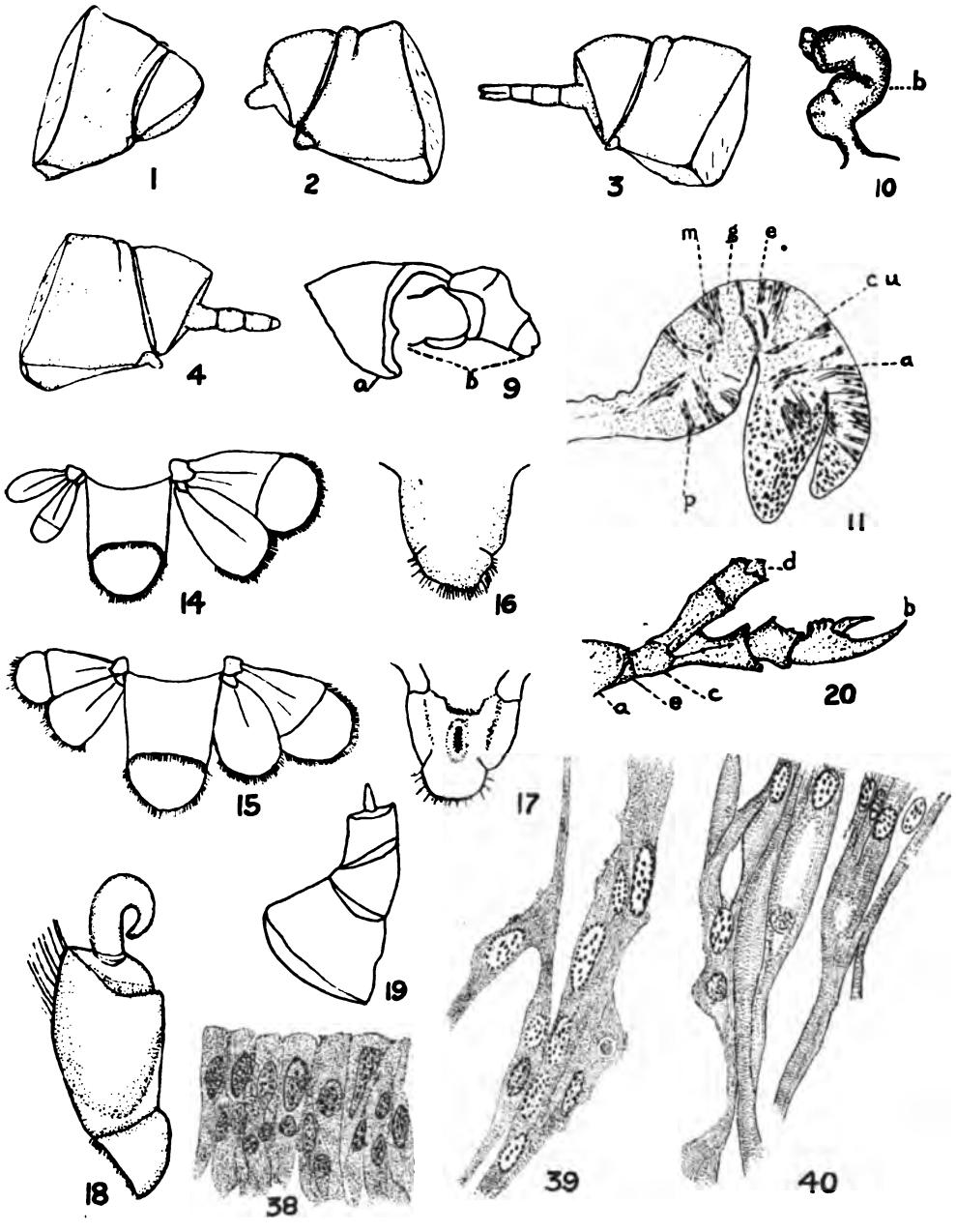
Fig. 32. Another crayfish, shown as in Fig. 31, except rostrum has not been removed.

Fig. 33. The same as Fig. 31, except that in this specimen left eye instate of right had been removed, and the regenerated structure is composed of a greater number of segments. Regeneration shown has taken place in two months, one moult having occurred.

Fig. 34. Similar to the preceding.

Fig. 35. Normal eye and regenerating eye six weeks after removal of entire cornea, one moult having taken place.

Fig. 41. Muscle fibers taken from *a*, Fig. 26a.



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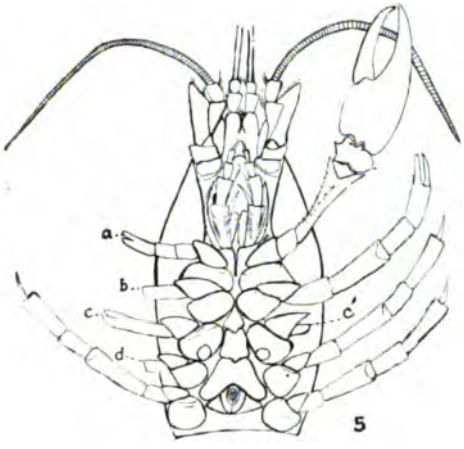

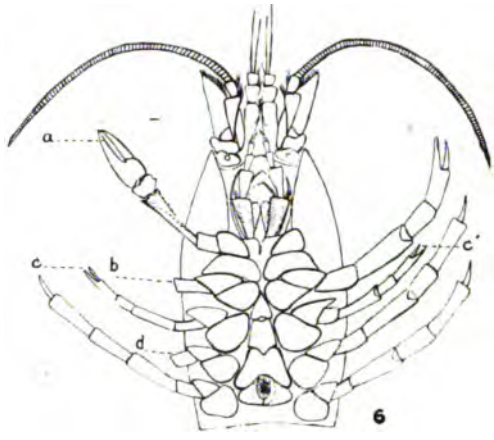

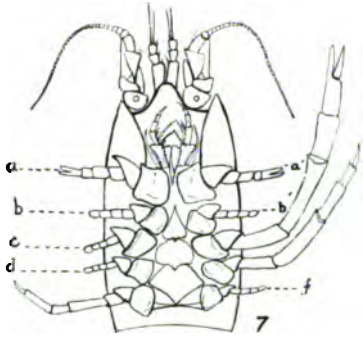

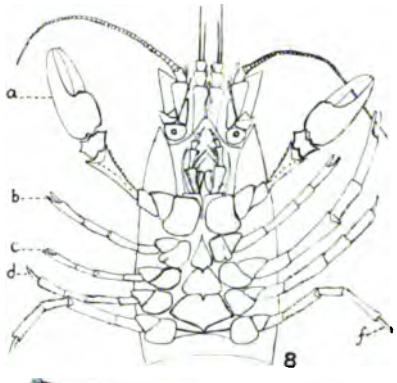

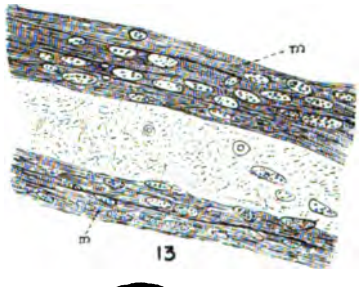

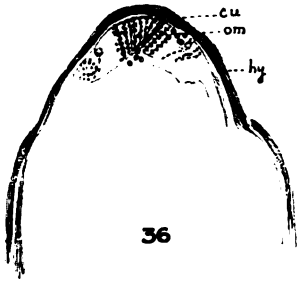

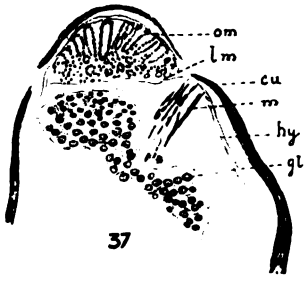

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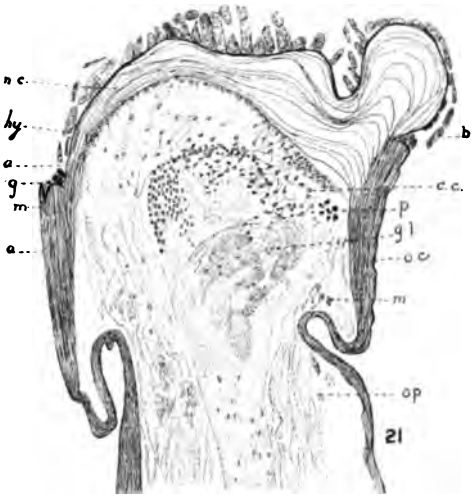

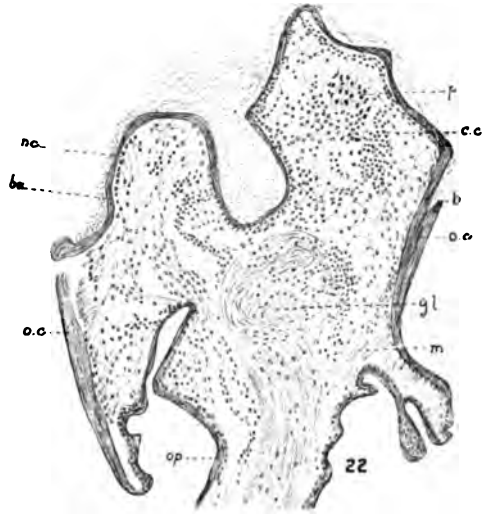

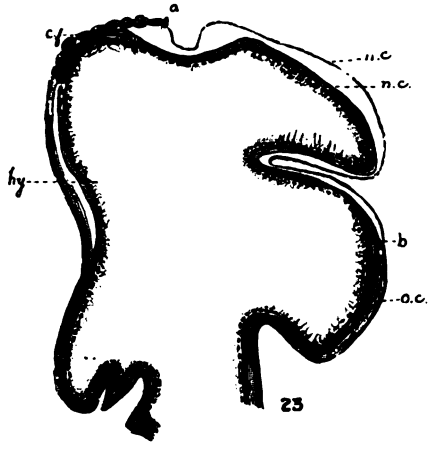

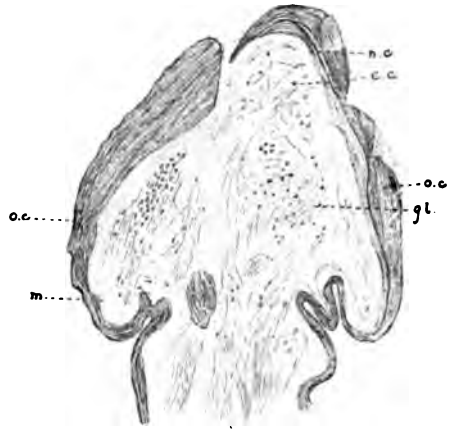

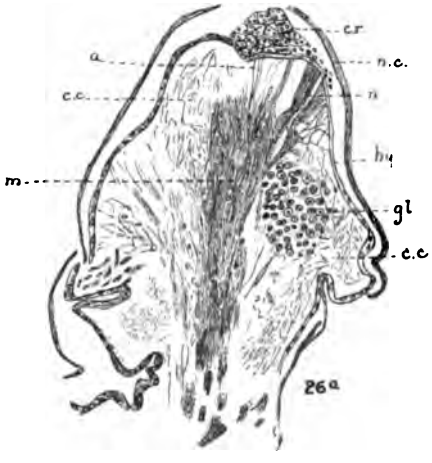

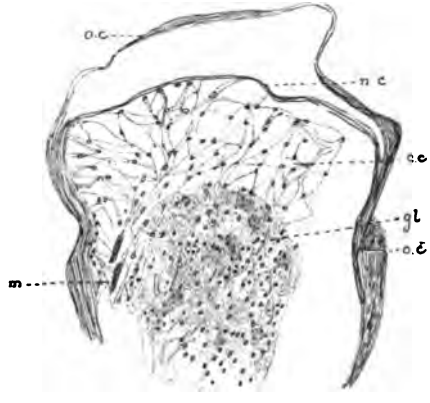

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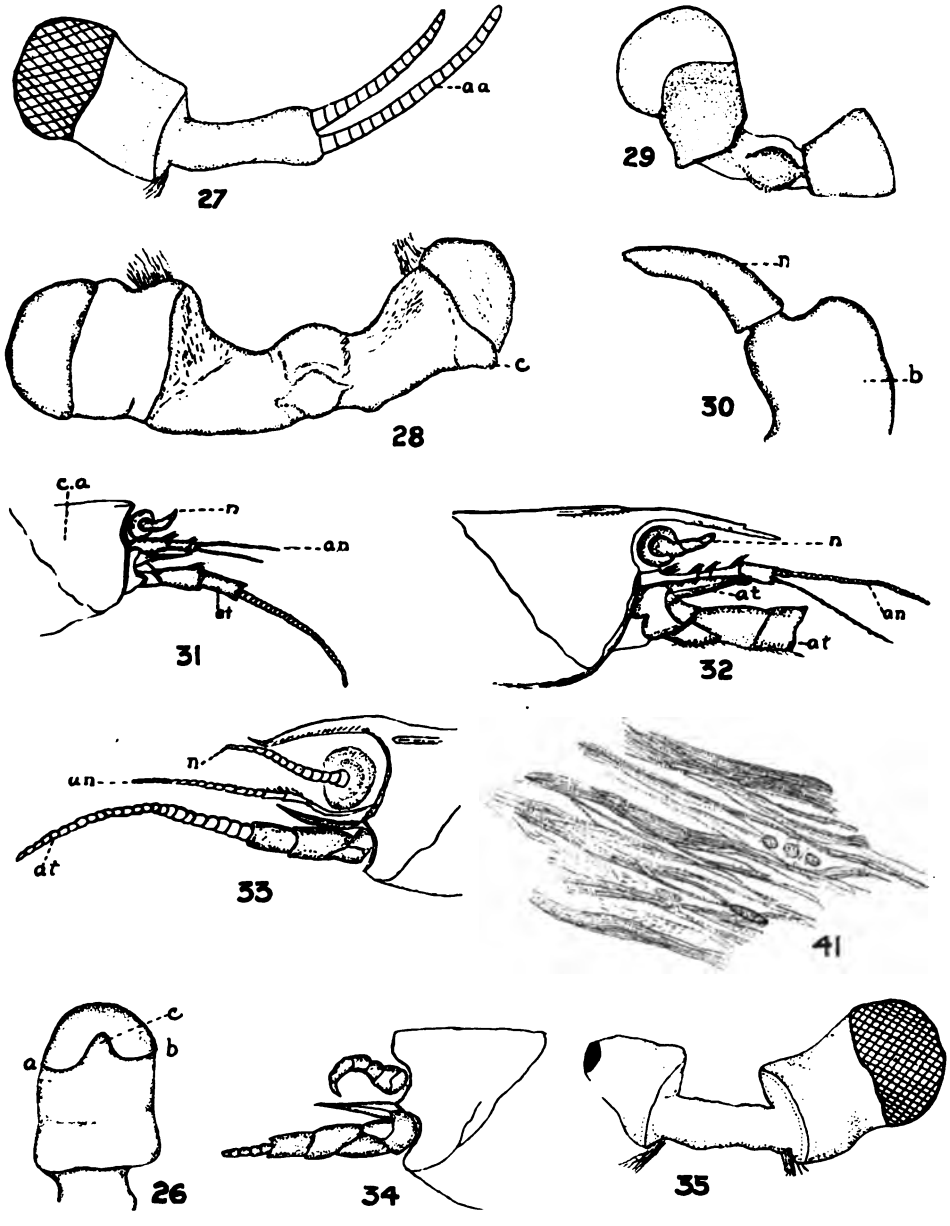

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DEPARTMENT OF ZOÖLOGY

A DISSERTATION SUBMITTED TO THE FACULTY OF THE GRADUATE DEPARTMENT OF THE UNIVERSITY OF MISSOURI, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS.

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THE SPERMATOGENESIS OF ANAX JUNIUS

INTRODUCTION.

The observations of which this paper is the outcome were made upon the larva of Anax junius Drury,[1] one of the most widely distributed dragon-flies. The results, in the main, are strikingly similar to those obtained by Paulmier ('99) in Anasa tristis.

The investigation was carried on in the Zoölogical Laboratory of the University of Missouri, and my warmest thanks are due to Professor George Lefevre for the valuable assistance which I received from him during the progress of the work.

I. MATERIAL.

The larvae of Anax are found most commonly in ponds and small streams. They are elongated, rapidly swimming forms, of brown color, more or less flecked with green and yellow. They may be obtained at all times of the year. In late summer, only very small nymphs are found; by winter, they are considerably larger; and in spring and early summer, all sizes, from individuals just emerging from the eggs to those four or five centimetres in length, are seen. In warm weather, they crawl about on the

[1] Professor J. G. Needham has kindly identified the larva for me.

water-weeds, or swim freely near the surface, but as winter approaches, they bury themselves in the mud beneath the surface, and at this season can only be gotten by dredging.

II. METHODS OF FIXING AND STAINING.

In removing the testes, the abdomens of the nymphs were opened while submerged in normal salt solution, the testes clipped out with fine scissors, and transferred as quickly as possible to the fixing fluid. For fixation, a number of solutions were tried, but Flemming's fluid gave by far the best results. In this the testes were placed for twenty-four hours or longer. They were then washed in running water, passed through graded alcohols, cleared in xylol, and embedded in paraffin. Sections were cut four and five micra in thickness.

For staining, Heidenhain's iron-haematoxylin and Flemming's triple stain were employed, the former giving the more satisfactory results.

III. THE TESTES.

The testes appear in late winter, or early spring, as long, white filaments, one on either side of the digestive tract, and extend almost the entire length of the abdomen. The early development of the testes was not studied, but in the youngest stages observed, each consists of a large number of globular cysts arranged one or two layers deep around a central duct which runs the entire length of the organ. The cysts in the young testes contain only spermatogones. There is no division into lobules, as is the case in the testes of so many insects. The only change in general appearance, as the testes become older, is an increase in the number of cysts and a still more noticeable increase in the number of cells in each cyst. The greatest growth is at the middle of the organ, so that it changes from filaform to spindle shape.

Although the cysts of the youngest testes contain only spermatogones, soon maturation divisions appear, not only at one end, as in many forms, but in scattered cysts throughout the entire structure. Thus it is possible, in older testes, to find all stages from spermatogones to spermatids in a single cross-section. With few exceptions, all the cells in each cyst are in the same stage of development.

Scattered among the cysts filled with spermatogones are numbers of smaller cysts, containing what appear to be degenerating cells. In the nuclei of these cells, the chromatin, instead of being in a net-work, is collected into solid masses. Many of the nuclei are found to be dividing amitotically. The cytoplasm also shows evidences of degeneration, having decreased in amount, and, in many cases, become vacuolated. Wilcox ('95) has described similar groups of cells in the testes of Cicada and Caloptenus, and these seem to be much like the degenerating cells in the testes of Anasa tristis, which Paulmier ('99) thinks are food cells. From the fact that they occur only at the time of most rapid growth, it seems that his idea concerning their function is the correct one. They have their origin from normal spermatogonial cells, and all stages, from normal spermatogones to cells which show all evidences of degeneration, can be traced in a single cyst.

IV. SPERMATOGONIAL DIVISIONS.

The resting spermatogones show typical cell structure (Fig. 1). The chromatin is in a fine granular reticulum and in the meshes of this reticulum are one or two chromatin bodies. Passing among the threads of chromatin is a more delicate net-work of linin. The cytoplasm is alveolar in structure. Centrosomes are never seen until the prophase of mitosis.

When preparing to divide, the chromatin forms into a coarse net-work (Fig. 2), and soon after is arranged as a con-

tinuous spireme (Fig. 3), which very soon breaks up into a number of segments (Fig. 4). The segments shorten and thicken, becoming compact, oval masses (Figs. 5-7). The first indication of a longitudinal split is in the stage shown in Fig. 6, where indentations are seen at the ends of the rod-shaped chromosomes. This split is more marked in Fig. 7. As the chromosomes continue to condense, they become lengthened eventually in the axis at right angles to the longitudinal split, until, in cells like those shown in Figs. 8 and 9, what is known from its development to be the longitudinal split really appears to be transverse. The chromosomes by this time are dumb-bell-shaped bodies. At this point the nuclear membrane disappears, and at the same time the centrosomes, with astral fibres radiating from them, appear in the cytoplasm (Fig. 10). As no centrosomes can be seen in the resting cell, it must be concluded that they are not persistent structures or else that there is a time during the resting period of the cell when they do not stain. Some of the astral radiations stretch out, and, becoming attached to the chromosomes, draw them into the equatorial plate (Fig. 11). In cross-section of the equatorial plate, the chromosomes can be counted for the first time and the somatic number, twenty-eight, is obtained (Figs. 12 and 13).

The chromosomes in the equatorial plate are loosely grouped into a more or less irregular mass in the center of the cell, and do not form a ring as in Anasa tristis. In this grouping there is a tendency for the larger chromosomes to be placed on the outside, the smaller ones within, although this is not always the case. In most instances the chromosomes are bound together by threads of chromatin (Fig. 12). In all cells the variation in the size of the chromosomes is apparent. This may be seen in cells like the one represented in Fig. 13, where the largest chromosome is at least five times the size of the smallest. No grouping of the chromosomes into pairs with regard to

size, as Sutton (:02) has observed in Brachystola magna, is found. However, two of the chromosomes are very much smaller than the others (Fig. 12, *a*), and there is reason for distinguishing these from the ordinary chromosomes, as will be seen when the description of the second maturation division is reached. The name "accessory chromosome," used by McClung for similar bodies in other insects, is perhaps the most satisfactory term and will be employed in this paper.

The accessory chromosomes of Anax are comparable with the "small chromosomes" of Paulmier ('99) and the "chromatin nucleoli" of Montgomery (:01), although in this form their continuity throughout the spermatogonial and maturation divisions can not be traced, as has been done in some cases of insect spermatogenesis. In most forms where the accessory chromosomes are found they are persistent cell-structures, appearing in the resting cells as chromatin bodies embedded in the meshes of the nuclear reticulum, which, when stained with iron-haemotoxylin, can not be distinguished from chromatin, but when Flemming's triple stain is used these bodies take the safranin rather than the gentian violet stain. In the prophase of mitosis they remain apart, not entering into the formation of the general spireme thread, and still staining with safranin. As mitosis continues they begin to take the gentian violet and are indistinguishable from the other chromosomes, unless they happen to differ from them in size, as in Anasa tristis, where they are very much smaller than the ordinary chromosomes. In Anax the accessory chromosomes at no time differ from the other chromosomes in staining qualities, neither do they remain as separate masses in the nucleus when the ordinary chromosomes fuse to form the continuous spireme, but unite with the other chromosomes to form this spireme.

After being drawn into the equatorial plate, the chromosomes, accessory along with the others, completely separate at

the constriction, which, it will be remembered, represents a longitudinal split. The halves then begin to move toward the poles of the spindle (Figs. 14-16). At this time the centrosomes and spindles are most distinct. As the chromosomes separate, interzonal fibres appear between the chromatin-masses (Figs. 15-16). When the chromosomes reach the poles of the spindle, they arrange themselves in oval groups around the centrosomes, groups which, however, are never so condensed but that the individual chromosomes can be seen in well-stained preparations (Fig. 16). Soon the chromosomes become irregular in shape, sending out strings of granules which unite with similar strings from neighboring chromosomes to form a reticulum. The reticulum is characterized by conspicuous net-knots, which are simply the remains of chromosomes which have not been resolved into the general net-work (Figs. 17-18).

When the constriction appears which is to separate the cells into the daughter spermatogones, the cytoplasmic bridge and the interzonal fibres between the chromosome masses begin to lengthen, stretching out longer and longer, until a mere filament remains connecting the cells, and this filament soon disappears. In consequence of this lengthening of the interzonal fibres, the daughter cells come to lie some distance apart in the cysts. As the interzonal fibres lengthen, they become wavy and have the appearance of pushing the cells apart. Shortly before the division is complete, the nuclear membrane forms around the chromatin reticulum.

V. MATURATION DIVISIONS.

1. *Growth Period.*—The period just preceding the beginning of the maturation divisions is characterized by the rapid growth of the spermatogones, the cells fully doubling in size. This is well shown by comparing one of the young daughter spermatogones in Fig. 18 with the later cell ready for maturation

in Fig. 20. This growth period shows an increase in the amount of chromatin as well as of cytoplasm. During this time one or two chromatin masses again appear in the meshes of the reticulum, which, however, can not be shown to be identical with the accessory chromosomes observed in the spermatogonial stages, though similar structures have been found to persist throughout growth and synapsis stages and become the accessory chromosomes of the spermatocytes (Paulmier, '99, and Montgomery, :01).

2. *Synapsis.*—After the growth period the fine reticulum of the last spermatogone condenses into a coarser net-work (Fig. 19) and then separates into a heavy spireme (Fig. 20). The strands of the spireme draw together at one side of the nucleus into a knot, never so condensed as to obscure its thread-like structure. This is the synapsis (Fig. 21).

3. *First Maturation Division.*—After a time, the dense knot of chromatin seen in synapsis begins to loosen and the chromatin comes out in the same form in which it went in, in a continuous spireme (Figs. 22-23). Soon the spireme segments, and at the same time a longitudinal split appears in each segment (Figs. 24-25). Although the number of segments, because of the twisting of the threads, can not be counted, yet it is clearly seen that there are not as many segments as there were chromosomes in the spermatogones. Many of the segments show also a transverse split. In all the material that was well stained, this split is visible as soon as the spireme segments (Figs. 25-26, *a*). Bands of linin fibres connect the segments and also the parts of the segments separated by the transverse split (Fig. 26). The early appearance of this transverse split and the reduction in number of the chromosomes, as will be seen a little later, from twenty-eight to fourteen, are the only evidences shown by this material that the chromosomes of the first maturation division arise by a fusion of the spermatogonial chromosomes end to end in pairs.

The two parts of the longitudinally split chromosomes begin to diverge in the region of the transverse split, and, as this goes on, the parts of the chromosome shorten and thicken, forming crosses (Figs. 27-29). The pulling apart of the limbs of the crosses in the transverse direction continues, but never to such an extent as to make the transverse arms as long as the longitudinal. Very often, while the chromosomes are still cross-shaped, the nuclear membrane disappears, and, simultaneous with its disappearance, the centrosomes with their accompanying astral fibres come into view. The astral fibres on the side next the chromosomes grow out and, attaching themselves to the ends of the crosses, pull them into the equatorial plate (Figs. 30-31). The crosses are arranged in the equatorial plate with the long axis and the corresponding longitudinal split always parallel with the spindle fibres, so that the first division is a transverse or reducing division. This confirms the observations of many writers on insect spermatogenesis (Paulmier, '99, in Anasa tristis, Montgomery, '98, :00, :01, in many of the Hemiptera, and vom Rath, '92, in Gryllotalpa) that in insects it is the first maturation division which is the reducing division. This view of the sequence of the maturation divisions is opposed to the results obtained among insects by McClung (:00, :02) in the Acrididae and Locustidae, Sutton (:00) in Brachystola magna, and among other Arthropods, by Blackman (:03) in Myriapods and by Rückert ('94) and Häcker ('92) in Crustacea.

During the time the chromosomes are being drawn into the equatorial plate, they change from the cross to the tetrad-form. This is accomplished by the condensation of the four parts of the cross into four oval bodies separated from each other by the longitudinal and transverse splits, the longitudinal grooves running parallel with the spindle fibres (Figs. 32-34).

In cross-section of the equatorial plate the reduced number of chromosomes, fourteen, can first be counted. The tetrads in

cross-section are dumb-bell shaped. The difference in the size of the chromosomes is even more noticeable in this division than in the spermatogonial (Fig. 35). Of the fourteen chromosomes, one is the accessory. This chromosome is smaller than the others, and, instead of being a tetrad, it is an oval mass of chromatin, with sometimes a constriction which makes it dumb-bell shaped. In cross-section it appears as a single oval body (Fig. 35).

The spindle fibres are double threads, one single thread passing to each oval mass of the tetrad (Fig. 36). When the chromosomes divide and separate, strands of chromatin remain between them, so that the interzonal fibres of the spindle seem to be of chromatic origin, as Paulmier has described for Anasa tristis.

As the chromosomes separate, the accessory chromosomes pass toward the poles of the spindle more slowly than do the ordinary chromosomes and are on this account easily distinguished from the others (Figs. 37-38). The interzonal fibres now are seen to be wavy and granular.

As the chromosomes approach the poles of the spindle, they become larger and less deeply staining (Fig. 39), and soon after reaching the poles begin to break up into a reticulum, but never to such an extent as to obscure their identity; the centrosomes disappear and the nuclear membrane forms (Figs. 40-42). Almost immediately the nuclear membrane disappears and the cells prepare for the second maturation division. In fact, it often happens, that no nuclear membrane forms around the chromosomes after the first maturation division, the second division beginning without any indication of a resting stage.

4. *The Second Maturation Division.*—As soon as the nuclear membrane disappears, the chromosomes separate into dumb-bell shaped masses. In cases where the resting stage is omitted, the chromosomes can be traced directly from the previ-

ous division, when it is found that the constriction seen in the chromosomes is the longitudinal split which was observed in the formation of the tetrad (Figs. 43-44). Centrosomes and spindle fibres appear and the chromosomes are drawn into the equatorial plate (Figs. 45-46). In Fig. 46 the small chromosome is visible at the side of the spindle. Fig. 45 is a cross-section of the equatorial plate, showing the reduced number of chromosomes, fourteen.

The chromosomes are now drawn toward the poles, chromatin strands remaining between and forming the interzonal fibres. The accessory chromosome does not divide as do the others, but passes entire to one pole, being easily distinguished from the remaining chromosomes, because in this division, instead of lagging behind as in the first maturation division, it precedes the other chromosomes, reaching the pole of the spindle some time before the rest (Figs. 46-49).

The chromosomes, on reaching the poles, fuse more or less (Figs. 51-52), the centrosomes and astral fibres disappear, and nuclear membranes form around the chromatin masses, the resulting cells being the spermatids.

VI. SPERMATIDS AND FORMATION OF SPERMATOZOA.

As soon as the nuclear membrane forms around the chromosomes of the spermatid, the chromatin is resolved into a reticulum (Figs. 53-54), and the cell, without further division, is transformed into a spermatozoön.

Although the centrosomes and astral fibres of the last spermatocyte division disappear as soon as the spermatids are formed, the spindle fibres remain for some time at the side of the nucleus (Figs. 52-54), and then break up into a granular mass, the "nebenkern" (Figs. 53-56). A darkly staining granule, having the appearance of a centrosome, appears in the center of the "nebenkern" (Fig. 55.) This granule grows very rapidly and forms the mid-body of the spermatozoön. While it is yet quite

small, the axial filament grows out from it (Figs. 56-57). About the time the axial filament appears, a darkly staining body forms at one side of the mid-body and appears to be merely a condensation of the granules of the "nebenkern" (Figs. 56-57). This mass gradually passes around the nucleus, becoming more condensed as it goes, until, when it reaches the side of the nucleus opposite the mid-body, it is almost as darkly staining as the mid-body itself (Figs. 58-61). It remains at this point and becomes the acrosome of the mature spermatozoön.

Along with the growth of the mid-body and of the axial filament, there is a lengthening of the nucleus of the cell and a condensation of the chromatin into a narrow band around the margin of the nucleus (Figs. 59-63). The essential facts here are identical with the transformation of the spermatids of Anasa tristis as described by Paulmier ('99).

VII. SUMMARY.

1. The spermatogones are arranged in small cysts. There is no division of the testes into lobes or follicles.

2. In the spermatogonial divisions the longitudinal split does not appear until the chromosomes are well formed.

3. The somatic number of chromosomes, twenty-eight, can be counted in cross-section of equatorial plate of the spermatogonial divisions.

4. Numerous cysts filled with degenerating spermatogones are found, many of the nuclei undergoing amitotic division.

5. Synapsis shows condensation of the chromatin-thread, from which the chromatin emerges as a continuous spireme which shortly breaks up into the reduced number of segments, fourteen. There is evidence that this reduction is due to a union of the somatic chromosomes end to end in pairs.

6. One chromosome is much smaller than the rest. This passes to the poles of the spindle more slowly than the others.

7. There is a noticeable variation in the size of the chromosomes other than the "accessory chromosome."

8. The first maturation division is a reducing division.

9. There is often a short resting stage between maturation divisions.

10. The centrosomes are not persistent cell structures.

11. In the second maturation division, the chromosomes separate along the longitudinal split. The accessory chromosome does not divide, but passes entire to one pole, and, as it precedes the ordinary chromosomes, it is easily distinguished.

Zoölogical Laboratory,
University of Missouri,
May 20, 1904.

BIBLIOGRAPHY

BLACKMAN, M. W.

:03. The Spermatogenesis of the Myriapods.—II. On the Chromatin in the Spermatocytes of Scolopendra heros. Biol. Bull., vol. v.

HÄCKER, V.

'92. Die Eibildung bei Cyclops und Canthocampus. Zoöl. Jahrb., Bd. v.

HENKING, H.

'91. Untersuchung über die ersten Entwicklungsvorgänge den Eiern der Insecten.—II. Ueber Spermatogenese und deren Beziehung zur Eientwicklung bei Pyrrhocoris apertus. Zeit. f. Wiss. Zoöl. Bd. LI.

McCLUNG, C. E.

:00. The Spermatocyte Divisions of the Acrididae. Kans. Univ. Quart., vol. IX.

:02. The Spermatocyte Divisions of the Locustidae. Kans. Univ. Sci. Bull., vol. I.

MONTGOMERY, T. H.

'98. The Spermatogenesis of Pentatoma up to the Formation of the Spermatids. Zoöl. Jahrb., Bd. XII.

:00. The Spermatogenesis of Peripatus balfouri up to the Formation of the Spermatids. Zoöl. Jahrb. Bd. XIV.

:01. A Study of the Chromosomes of the Germ Cells of Metazoa. Trans. Amer. Phil. Soc., vol. XX.

PAULMIER, F. C.

'99. The Spermatogenesis of Anasa tristis. Jour. Morph., vol. XV., Suppl.

RATH, O. VOM

'92. Zur Kenntnis der Spermatogenese von Gryllotalpa vulgaris. Arch. f. Mikr. Anat., Bd. XL.

RÜCKERT, J.

'94. Zur Eireifung bei Copepoden. Merkel und Bonnet's Anat. Hefte, 1894.

SUTTON, W. S.

:00. On the Morphology of the Chromosome Group in Brachystola Magna. Biol. Bull., vol. IV.

WILCOX, E. V.

'95. Spermatogenesis of Caloptenus femur-rubrum and Cicada tibicen. Bull. Mus. Comp. Zoöl., Harvard Coll., vol XXVII.

EXPLANATION OF FIGURES.

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Fig. 4. Segmented spireme.
Fig. 5. Shortening of the segments.
Figs. 6–9. Continued shortening of segments and appearance of a longitudinal split.
Fig. 10. Appearance of centrosomes and astral fibers.
Fig. 11. Chromosomes in the equatorial plate.
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Figs. 17–18. Chromosomes forming into a reticulum; nuclear membrane appearing.
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Fig. 57. Lengthening of axial filament; acrosome passing around nucleus.

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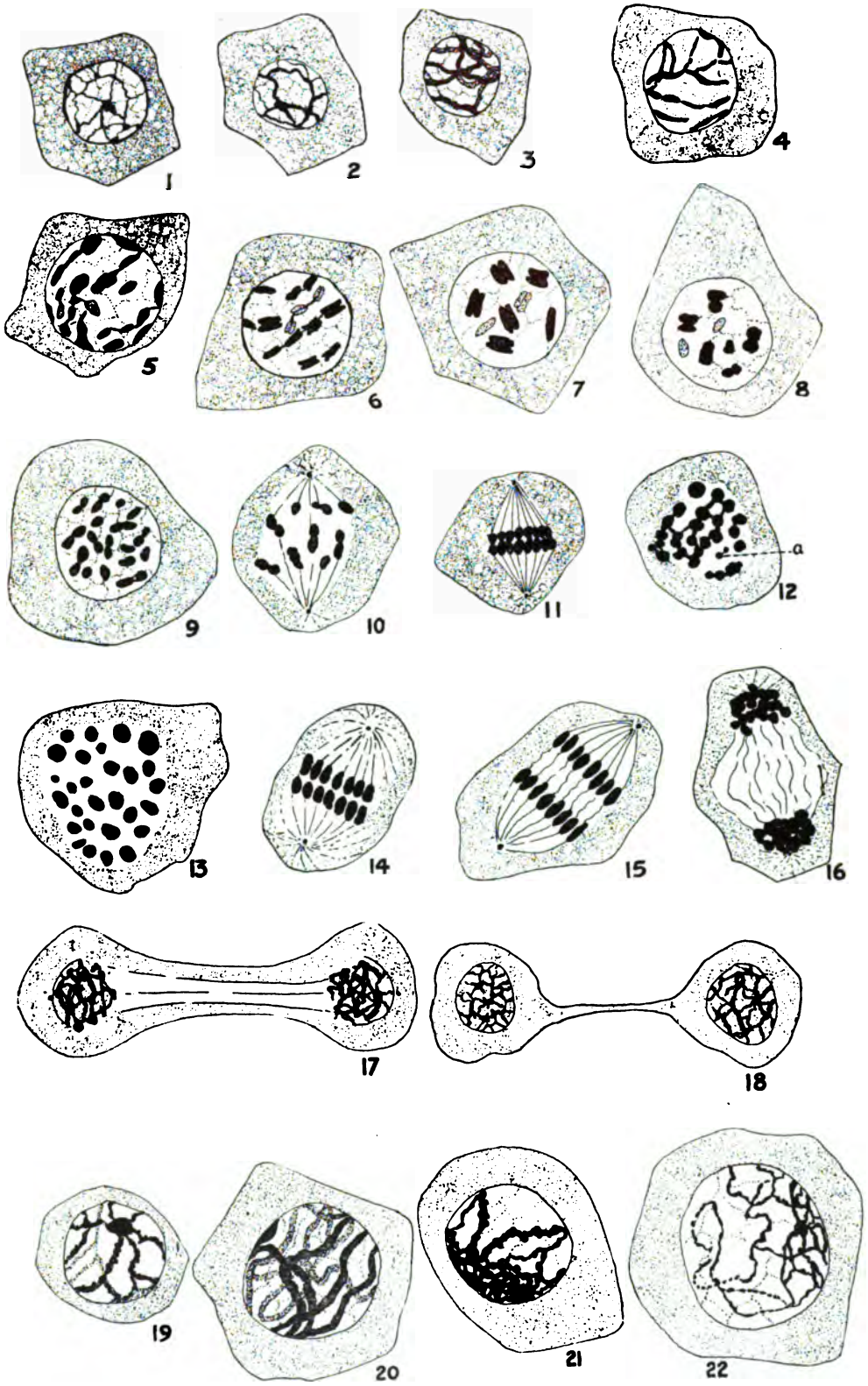
Figs. 61–63. Show continued elongation of all the structures of the cell, with further condensation of chromatin around the nuclear wall.



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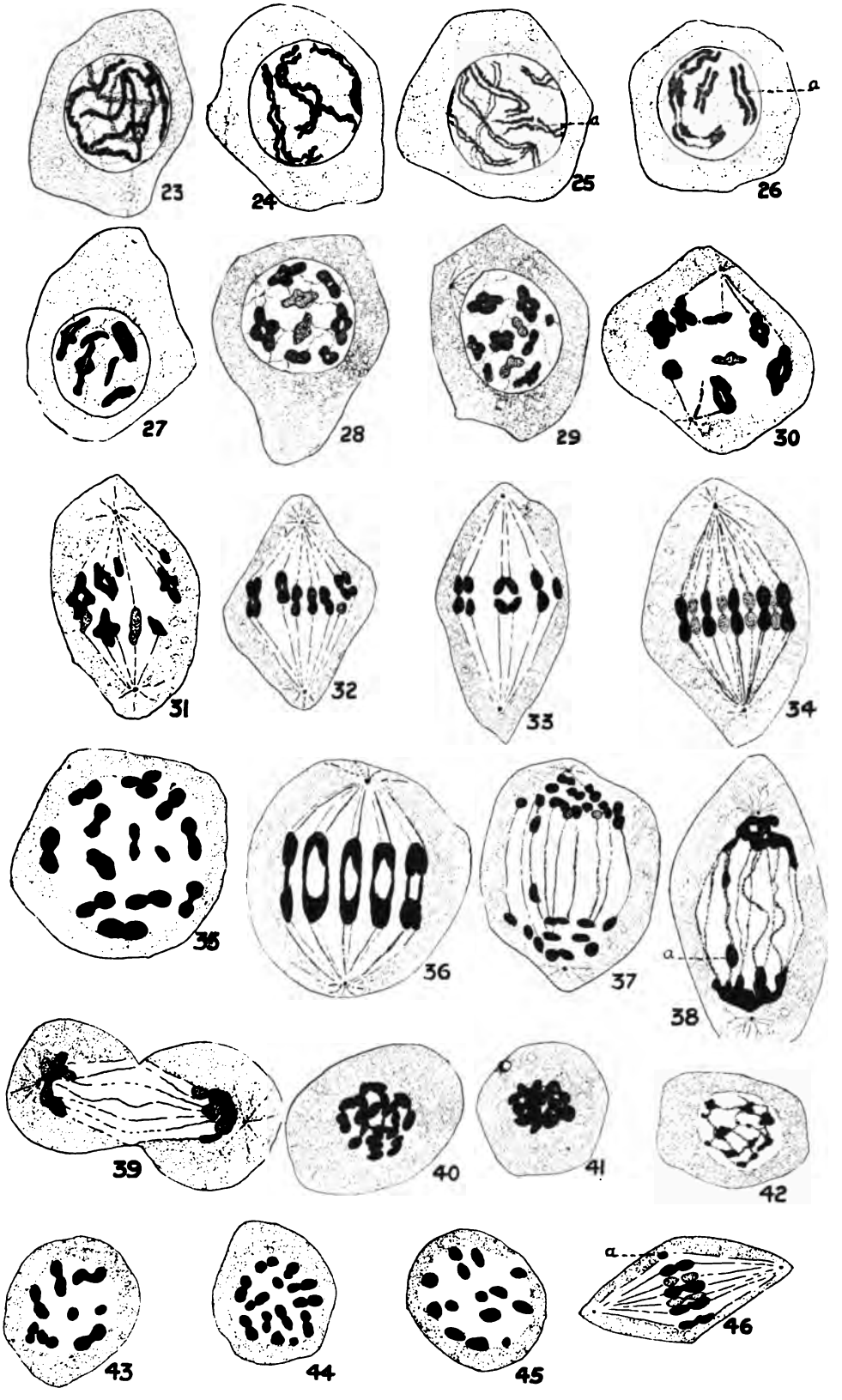

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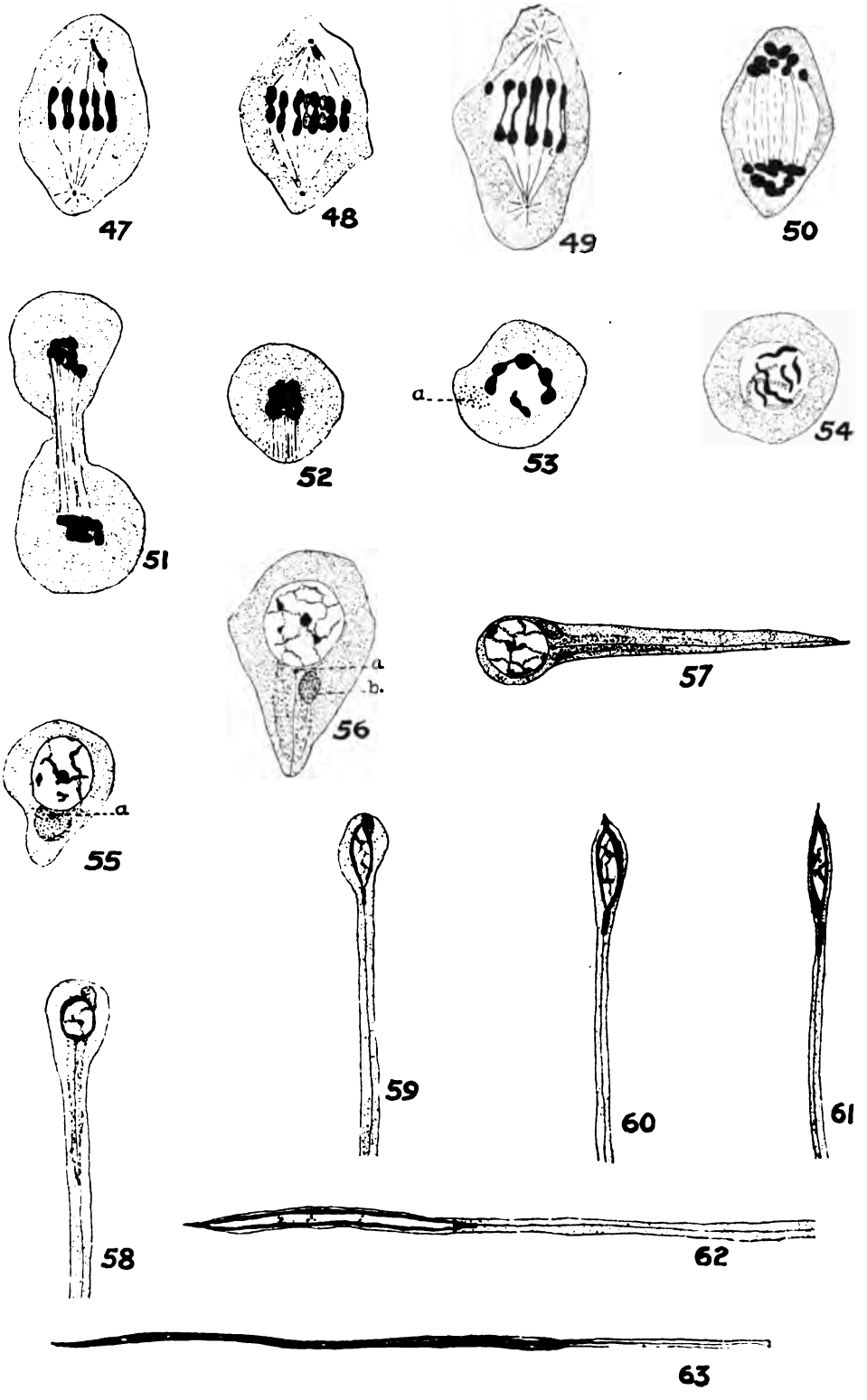

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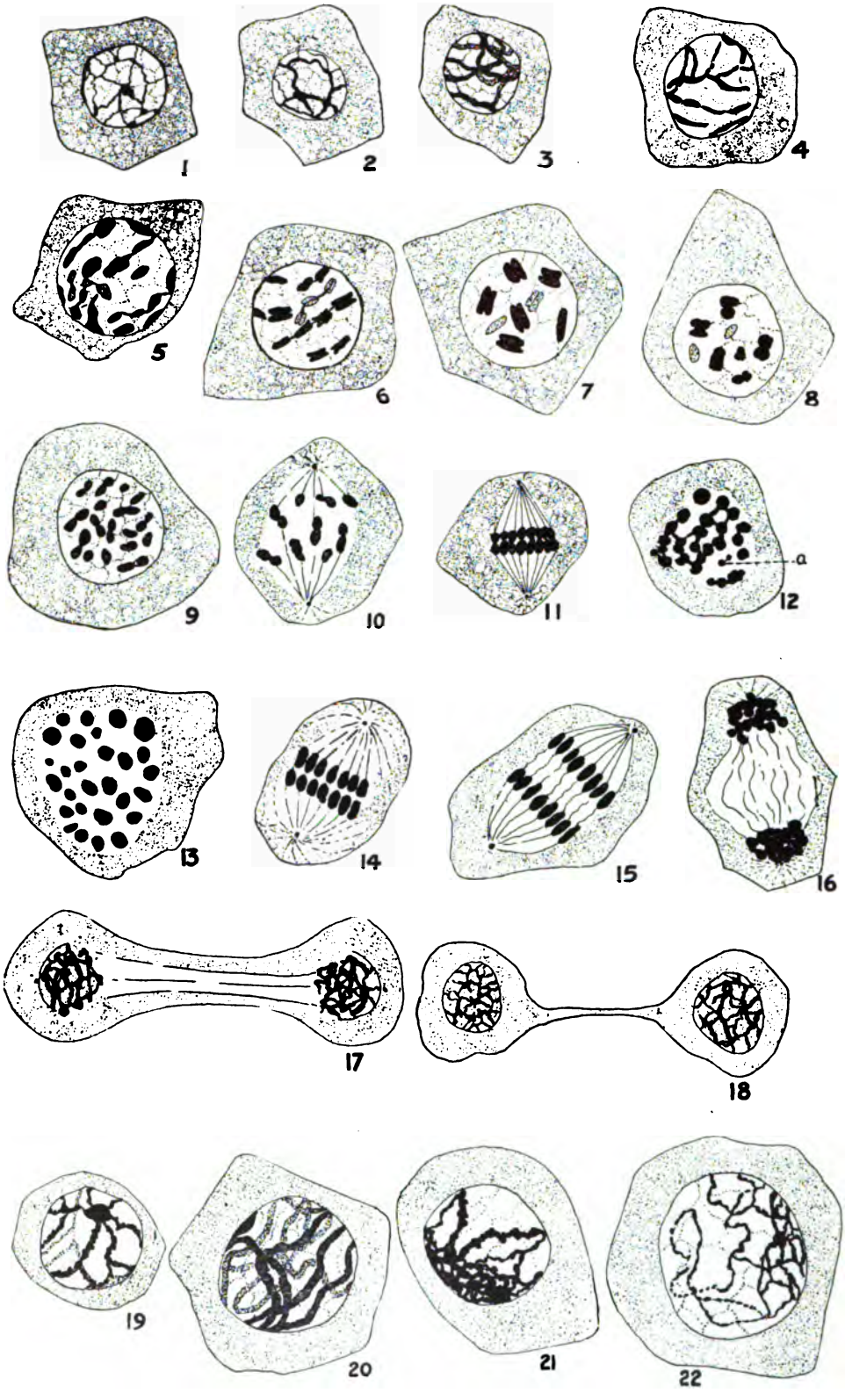

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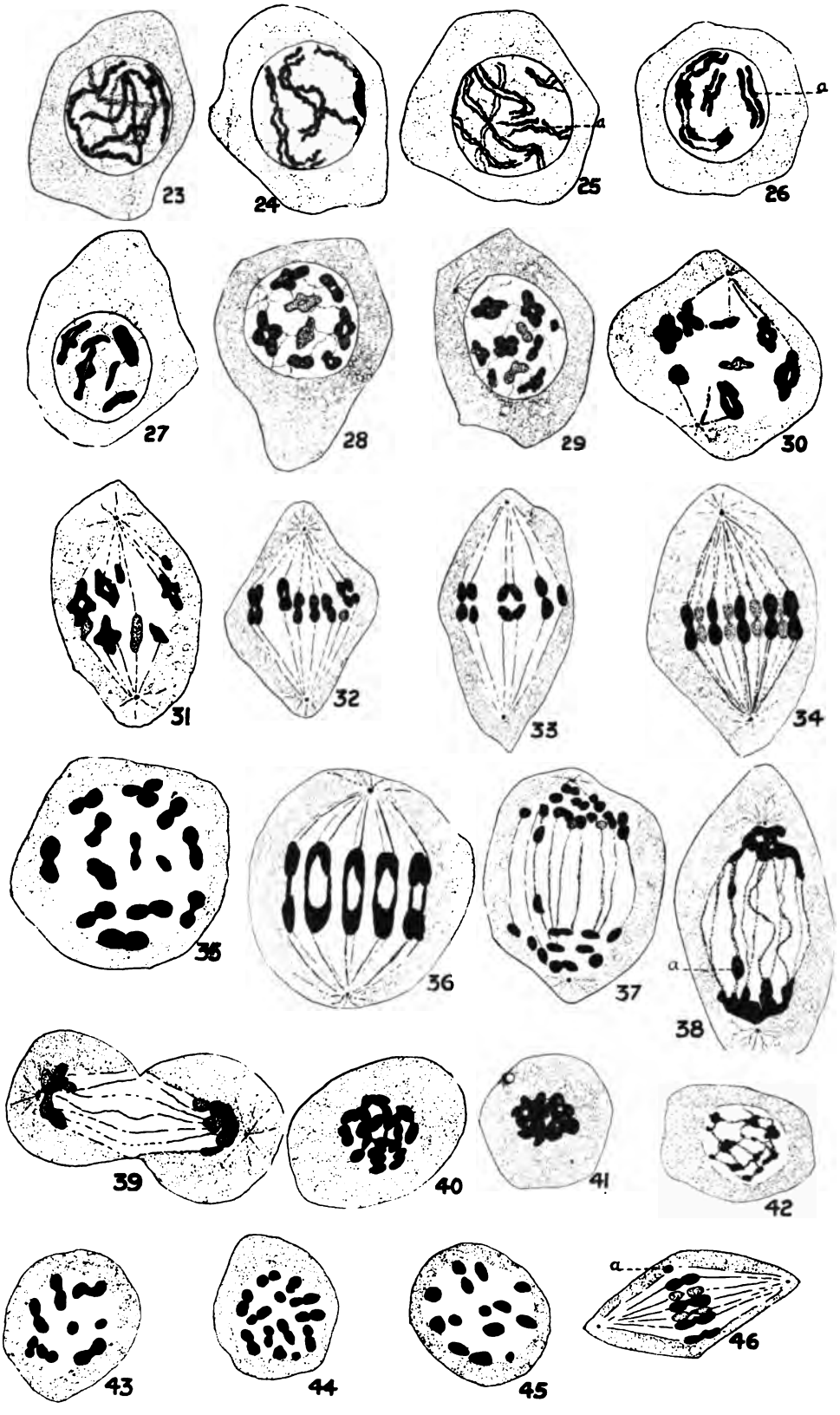

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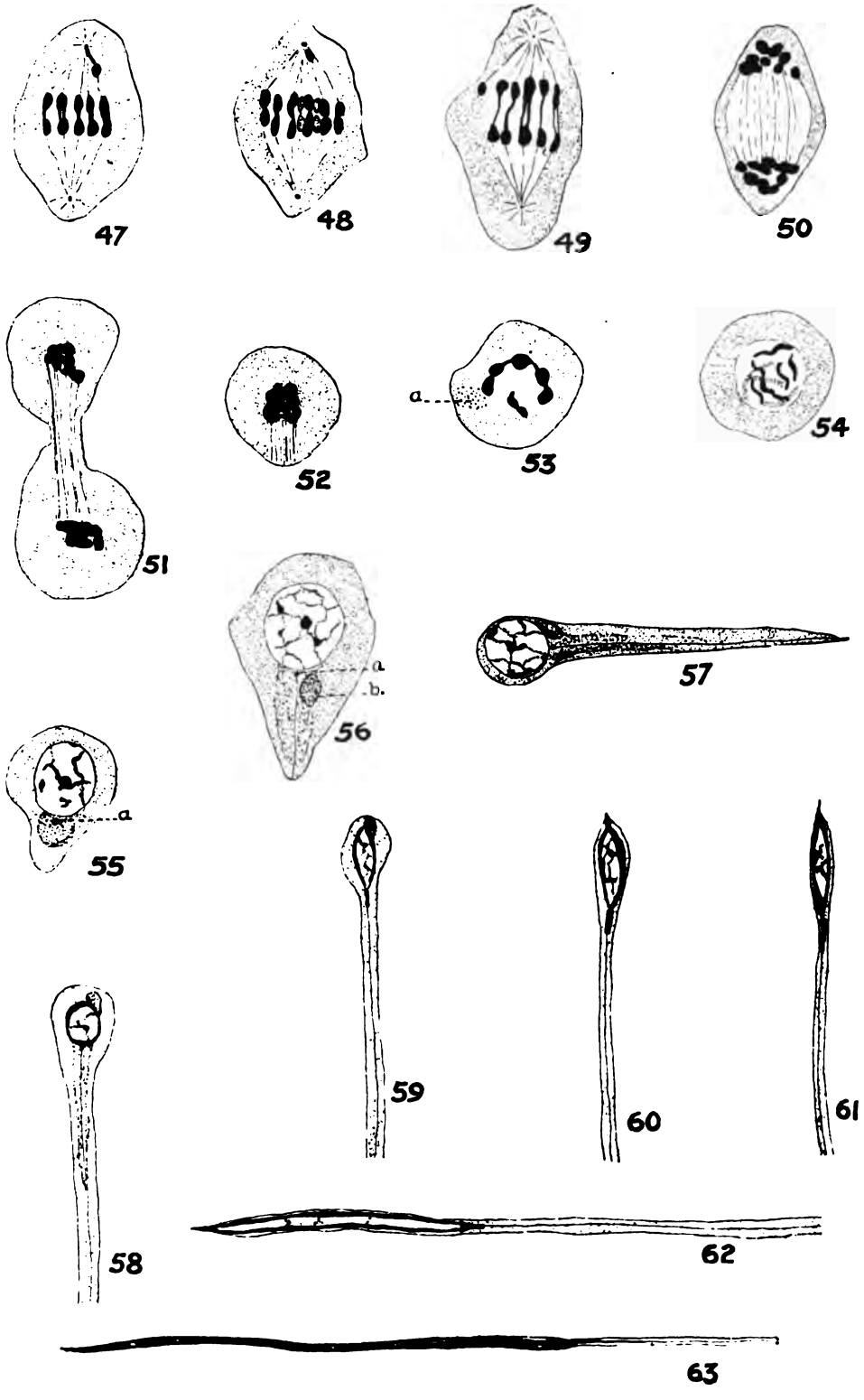

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